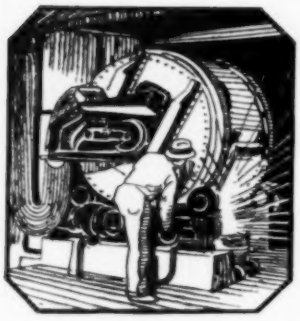


THE FOUNDRY

for January

Missing a CHANCE

DOING too much for children handicaps them when they must assume responsibilities for themselves. The same is true of adults. Those code authorities, doubtless from motives of entirely unselfish service, which have carried on with the same personnel through the formulation and entire life of code administration to date are likely to find the truth of this condition in the reaction when and if government support of worthy trade association functions through N. R. A. orders and actions is withdrawn. This is particularly true in those industries within which the leaders have not kept closely in touch with the membership. The cross section of opinion, obtainable only through industry meetings, held periodically or at least annually, is most valuable to those chosen to lead various industries at this time. The acquaintance, mutual interest and free discussion of such gatherings soon will form the basis for sound and constructive work under contemplated changes which, according to present outlook, will place added responsibility on trade associations and closely unified agencies of each industry.

Must Cut CORNERS

GOOD management in the period ahead will be measured by the ability to find and stop wastes in production. With wage levels frozen, costs of materials rising and uncertainties or lack of cash blocking an occasional profitable gamble on stocking metals and fuels against expected rises, profits can be found best in those corners which can be cut. In fact that will be about the only place to find them.

Recently, a foundryman of unusual ability along these lines found in his shop a discrepancy in weights on a job weighing about 27 pounds, with some 100 castings to deliver on the order. The carelessness of the workman in charge made a difference of about 4 per cent in his cash return. *Only* 4 per cent, expressed the attitude of the man at fault. "How would you like to have $96 for the next $100 the firm owes you," was the manner in which the foundryman drove home to the offender the effect of this careless viewpoint.

In large shops the drive for savings constantly is under way. In smaller foundries, the matter is even more important. The manager of a restaurant in a large hotel checks hourly the costs of his various items of food against the customers' checks paid. A maker of wooden ware found in as small a gadget as a golf tee, using waste cuttings, a profit of 3 per cent on his total yearly business.

The increasing attention to sand reclamation, wire and rod straightening machines, constant efforts to reduce the coke to iron ratio and hundreds of other examples of attention to major savings in the foundry represent the larger attention to savings. However, cutting the corners, making small savings in countless minor ways represents an even greater opportunity for changing the earnings statement from red to black, today.

Makes Good START

BETTER steel operation; increased sales reported from automobile shows; farm implement demand increasing; speed steps to increase building; and countless other similar pointers in random headlines from the business and daily press, give 1935 a good start. Increased operations in foundries in the automotive, stove and furnace, agricultural and many general jobbing lines indicate the immediate reaction in the foundry industry. Sales of foundry supplies steadily increasing, buying and inquiry for foundry equipment more active, support the hopeful attitude toward the future. It sure looks like a good year, from where we stand in January, 1935.

Fig. 1 — Getting ready to tap a heat of malleable iron

Producing Malleable Castings

Mechanical equipment facilitates accurate control over production of malleable iron

AFTER eight years of constant activity, the greatest feat of American engineering, up to that time, was completed in 1825 when the Erie canal, 352 miles in length, extending across the greater part of New York state from the Hudson river on the east to Lake Erie on the west, was opened to navigation. The total rise of 568 feet was accomplished through 72 locks varying in height from a few feet to the highest at Troy, 188 feet.

The canal had cost $7,602,000, but it reduced the freightage time between terminals from 20 days to 10; the passenger time to 3½ by a line of light packet boats drawn by relays of horses at a trot, and reduced freights at once from $100 a ton to $10 and then to $3. It made central New York, largely uninhabited, at once a district of potential empire with settlers flocking in. It secured for New York City the domination of the American seaboard, and created or solidified the prosperity of the remarkable line of cities in its path.

One of the most costly and difficult sections was blasted through a solid limestone hill in what is now the city of Lockport, 25 miles northeast of Buffalo. According to local tradition the area in this section of the state was a wilderness when the army of men and horses commenced operations. Before the job was completed, many of the workmen and others had set up permanent homes and established a settlement which rapidly expanded as a result of traffic moving east and west on the canal.

Fig. 2—A dry sand ring core fills the space between riser and casting

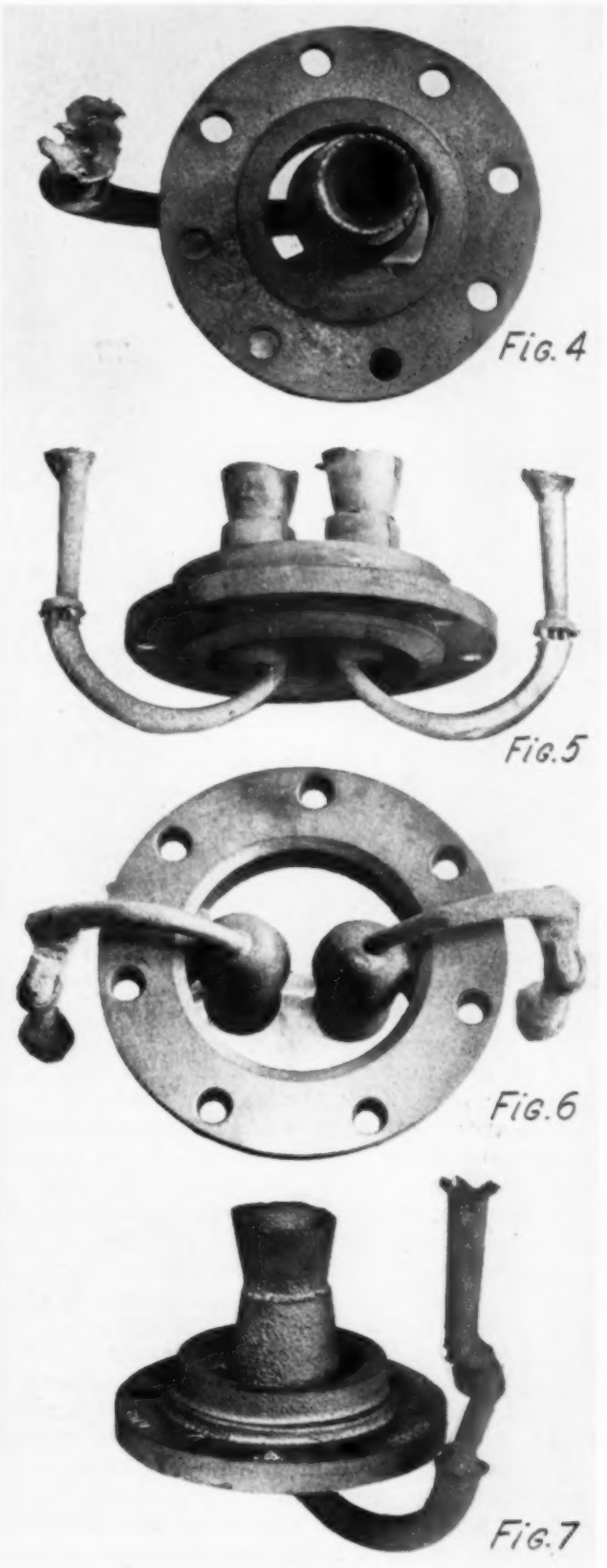
Perched high on facing hills which dip to the immense gash containing the canal and locks at the bottom, the present town with its many stone buildings is more reminiscent of Europe than America. The impression is still further heightened by the smooth, cut stone retaining walls of the canal and the numerous bridges erected at a period when cast iron was employed extensively for ornamental posts and guard railings on either side. On several occasions since it was first built, the width and depth of the canal have been increased with a consequent removal of more stone from the excavation. Most of this stone has been transferred to fills elsewhere. Some of it has been utilized for building purposes in the city and vicinity.

Old Plant Built of Stone

Walls of the greater part of a Lockport plant, built many years ago and occupied at present by the Jefferson Division of the Lockport Fittings Co. Inc., formerly the Jefferson Union Corp., are stone and in that respect offer marked contrast to the usual type of American industrial plant, wood in the older forms and steel, brick and concrete in those erected in more recent years.

Several years ago the foundry department was rebuilt with walls of hollow tile and with the roof supported by a double row of concrete columns. Owing to the local topography, the floor at the north end of the foundry is flush with the ground level outside, while at the south end

Fig. 3 — Legs and feet of the men pouring the iron are protected with safety appliances



Figs. 4, 5, 6 and 7—Several modifications are employed in the design of gates and risers where the metal enters the riser through a horn gate at the bottom and where a large riser in the center feeds the casting through a wide, deep horizontal opening

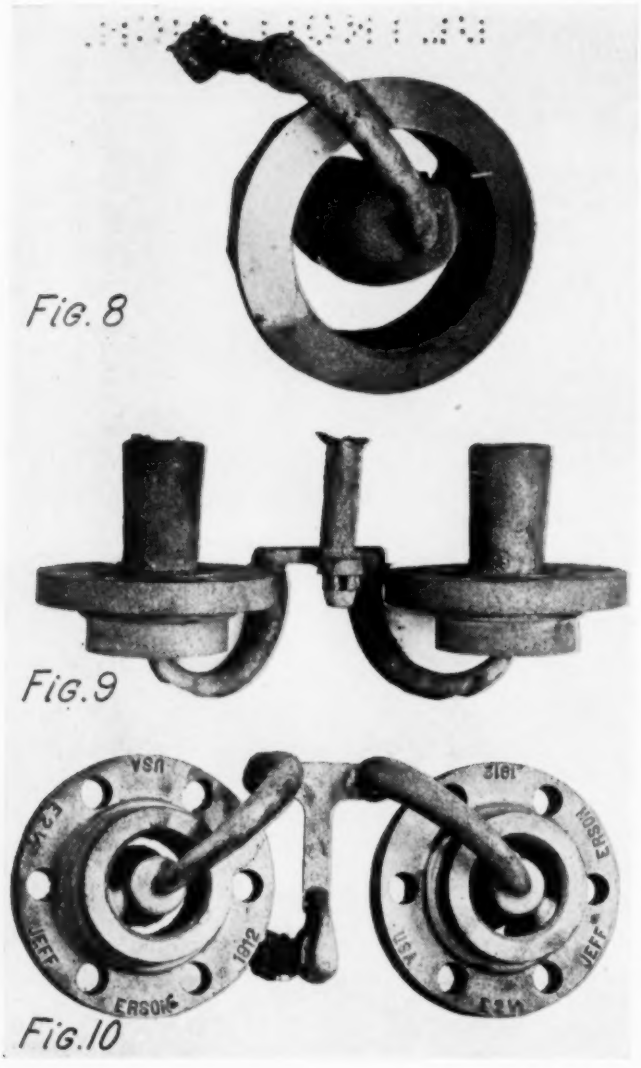


Fig. 8—Bottom side of the casting. Figs. 9 and 10—Side and bottom views of the application of dirt catchers in gates for two castings

it is 10 feet below the roadbed level of a spur from the New York Central railroad.

This arrangement presents certain advantages in the unloading of raw materials by gravity through chutes in the end wall. The floor of the shipping room in the story immediately above and to the west of the foundry, is at a convenient height for loading either trucks or railroad box cars with the finished product packed in barrels or bags. Extension of the foundry forms a basement under the shipping department and machine shop and is utilized as a sand mixing department, a storeroom for flasks, bands, and miscellaneous foundry supplies, and a stock pile of the materials to be melted in the furnace.

As in practically all malleable iron foundries the sprues, gates and risers absorb approximately 50 per cent of the metal melted in any given heat. Manifestly this return scrap must be incorporated in the charge for the succeeding heat which is made up of this return scrap 50 per cent, pig iron 35 per cent and malleable or steel scrap 15 per cent. Return scrap is carried in trucks or wheelbarrows to the vicinity of the furnace after the castings have been shaken out. Pig iron and scrap are unloaded by hand from railroad cars and placed on roller conveyors extending downward from the cars to the bins in the basement. From this point they are carried on trucks and charged in the usual manner through the roof of a 15-ton air furnace fired through one end with pulverized coal.

Coal Unloaded By Gravity

In the journey to the furnace, small lump coal not exceeding 2 inches in size falls through the bottom of a railroad gondola onto a reciprocating apron at track level. The apron is adjusted to deliver a definite sized stream to an inclined chute which discharges the coal into the boot of a bucket elevator which in turn discharges the coal onto an elevated belt leading directly to the dryer, or, to either one of two large concrete silos or containers with a combined capacity of approximately 1000 tons. Thus a reserve supply of coal sufficient for several months' operation is on hand at all times. Under normal operating conditions the monthly consumption of coal is 200 tons, sufficient to melt 500 tons of iron.

Coal is taken from the container through a small opening at one side near the bottom. A screw conveyor discharges the coal into the boot of the elevator previously mentioned. From the top of this elevator the coal is conveyed by belt to a dryer where all moisture is extracted by a current of hot air developed over a coke fire and drawn through the coal by a suction fan. The dried coal then is discharged into a pulverizer and reduced (*Please turn to page* 46)

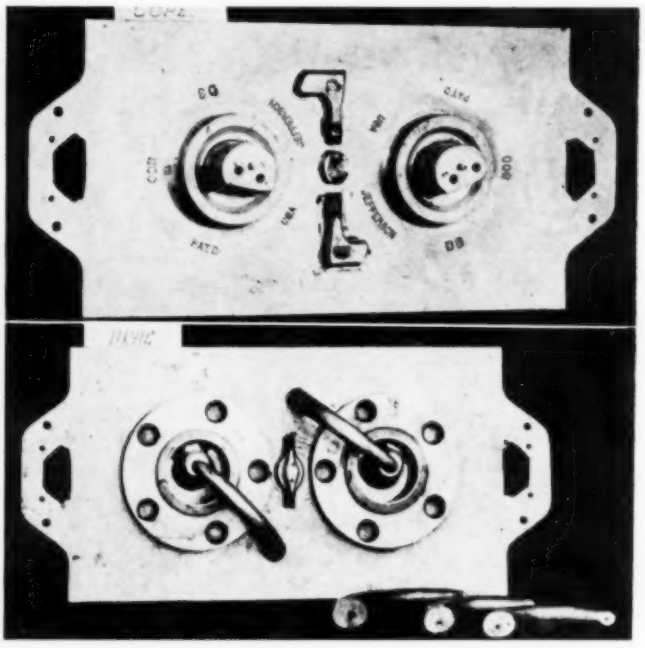


Fig. 11—Cope side of double flange pattern plate showing dowel pins for locating upper sections of riser blocks. Fig. 12 — Drag pattern plate for same castings. The horn gate patterns are detachable as shown at lower right

Points To Causes of Porosity

Liquid steel has an affinity for gas and may pick it up between furnace and mold

By R. A. BULL

THE term porosity in this article is employed without attempting to draw a fine distinction between the several small cavities formed by gas, which may exist in steel castings. There are interesting suggestive differences in the shapes, locations, and other observable conditions of those gas cavities, relatively so small as to be excluded from conventional classification under the term blow hole. Ordinarily makers of steel castings are accustomed to designate gas cavities of large diameter as blow holes, and gas cavities of small diameter (generally less than ¼-inch) as porosity or pin holes.

Some steel foundry metallurgists who have studied porosity intensively, have narrowed their consideration to each of several distinctive kinds of gas cavities of small diameter, in the understandable desire to distinguish those that come from improper metal conditions, those produced by defective molds, cores or both, and some that advantageously can be more narrowly identified. The author is in full accord with the purpose behind these differentiating efforts when it is obvious that they are made with the intention of relating causes and effects. Occasionally some analytical studies of this character, while having much potential value, are confusing to the practically trained superintendent and foreman.

For the purpose of the present discussion porosity is regarded as any form of gas cavity of small diameter, whether the cavity is wholly or partially spherical or elongated, and whether the defect lies in the central portion of a member or at such a shallow depth as to be apparent after the casting is shaken out, or is uncovered when annealing scale is removed. Where porosity exists, frequently (but not always restrictively) it manifests itself in cavities close to the skin of the metal. Often the holes are elongated, having at some point diameters comparable to that of the ordinary pin. Some of these cavities, at the surface exposed on the removal of annealing scale, are only large enough to permit the careful insertion of a pin; hence, the customary term, pin hole. Pin holes constitute one of the chief defects occasionally experienced by most foundries that specialize in the production of small, high grade steel castings. While the porosity evil is not confined to small pieces, its commercial significance in the lighter products of the steel foundry is greater.

The standard of acceptable appearance is higher for small castings than for large ones. To considerable extent (although there are numerous exceptions to the rule), the approach to perfection in appearance desired by the average consumer becomes greater as the casting becomes smaller. This discriminatory factor is soundly based on economic principles, so far as these apply to the current viewpoints of industrialists. The average observer is not likely to notice and be critical about a few pin holes in a base plate, but he would regard them as undesirable in an exposed motor truck bracket.

Cavity Influences Serviceability

Another reason for the greater commercial significance of pin holes in light castings lies in the fact that, in many instances, the influence of a gas cavity is potentially more serious in respect to serviceability of the small part than in the large casting. This is due to cross sectional dimensions and the established factors of safety. Many large steel castings purposely are made heavy, for the advantage derived partially from mass, supplementing dependence on the inherent stress resistance of the material. In the past, probably a large amount of metal in castings was wasted in supplying weight unnecessarily. For numerous applications mass is desirable, within reasonable limits. Careful judgment should be exercised in reducing weights of industrial parts to the apparent permissible minimum. Some present tendencies in weight reduction may be carrying the policy too far.

Gas cavities of every kind are found much less frequently than they were formerly in casting of comparable kinds, but the average consumer's attitude increasingly has become more exacting as to those details that affect surface appearance and more critical as to all factors that influence stress resistance. Apparently the changes in preventative measures in the foundry and in the viewpoint of the (*Please turn to page* 51)

Skill, obtained through training and experience, is needed especially in controlling operations in the foundry. Illustration courtesy Colorado Fuel & Iron Co.

The Oncoming Shortage of Skilled Mechanics

By KENNETH COOLBAUGH

WE ARE headed toward the most drastic shortage of skilled labor in our history. To the man after a job, to the employer after men—in short, to most of us—that ought to mean plenty.

First, take this younger generation. Since the dawn of 1930 I can recall not a single boy I've met in and out of my office of whom I could say when he had finally "landed something" that the job in itself offered him the faintest hope of acquiring the skill that earmarks a trade.

American industry ceased in late 1929 to teach skill to men of all ages. Glamorous exceptions merely copper-rivet the generalization.

Though nation-wide statistics are meager, studies made in selected industries in a definite area, notably in textiles and the building trades, all net approximately the same total. Through a country-wide hookup, Frank Cushman, chief, trade and industrial education service of the federal board of vocational education, gives us this recent picture of what we've done in training youth in tasks requiring skill:

One-fourth of our states report no apprentice training programs in co-operation with their public schools. The others report 31,595 apprentices enrolled in part-time and evening classes learning the fundamentals of 170 trades and occupations. New York, Illinois, Wisconsin and Ohio claim the spotlight. Potential building and construction mechanics head the list with embryo electricians and future machinists next.

As for apprentices trained on the job and sponsored by private enterprise, a scant third of our states report 11,994 enjoying the opportunity of learning a trade. Employers have been too busy, trying to keep the men they had, to pay new workers for the privilege of teaching them to be useful. As a result of this moratorium on training, there is no skill reserve to be drawn on.

But what of the skilled workers of other days, the journeyman machinist, millwright, metal worker, coppersmith, upholsterer, bushelman, molder, blacksmith—take your pick of 50 lines—whose trade is plied in thousands of cities, towns and hamlets, coast to coast?

"Easy enough to reach — a letter to the last known address."

The employment department of a local plant, a link in a giant chain of the electrical industry, knows better. For three years this plant had been supplying necessities to its long list of furloughed men. Slowly the number of them calling weekly at the plant's relief headquarters declined. Its employment manager sensed what was happening. He ordered a direct personal check-up and found 42 per cent of his former mechanics had moved from the city. The whereabouts of 36 per cent of them was, and still is, unknown.

A morning last autumn I stood in the employment office of a steel fabricating plant. Outside waiting men milled. Suddenly a phone jangled. The yard wanted six acetylene welders, three gangs of riveters — three men to a gang — a boilermaker layer-out and an anglesmith. The door was opened and the crowd outside surged in. An hour later the sifting process had netted two welders and a rivetter with three heatermen.

"Six skilled and semiskilled men from a crowd of 172," the employment man said. 'There

weren't, all told, 20 mechanics of any kind in the bunch. Six or 7 years ago I could have filled at least 16 of these 18 jobs just by going to the door."

Where were the journeymen? They had done as have hundreds I know; gone to live with in-laws down East or to a parental roof in a far state, opened hot dog stands and filling stations or homesteaded land beyond the horizon. The pioneer's spirit drove many, desperation drove others. The promise of their old jobs may intrigue a few of them — but only a few. Others feels as does an English-trained plush-mill machinist who today plants and sells nursery stock:

"Yes, it keeps me humping; the days aren't long enough, but I don't have to stand in line morning after morning or sit at home waiting. I was nearly bughouse. Now if I'm doing nothing it's my fault."

A steamfitter, a weaver and a piecegoods dyer work at helper's wages learning electrical refrigeration.

"I've had my eye on that line ever since I bought one, and lost it. It'll be better than ever with beer back."

"Even now it isn't nearly as up-and-down as my trade before the crash."

"It's new and it's different. I'm fed up on my trade."

Two high-tension linemen, a painter and three carpenters, their thin resources pooled, sell coal and truck it from mine to homes, private hospitals, small apartments and office buildings.

"It's good coal, cheap, and it's a spot cash business. We just bought another three-ton truck."

A fleet-wire welder, worth his passage money from any port, works a milk route in a seaside resort.

"No, I wouldn't go back to the noise and dirt up there if they'd let me write my own ticket. I haven't had a doctor for any of us since we came two summers ago."

A former optical lens grinder, a silver engraver, an awning maker, and a dental mechanic grace the top bracket of an investment-insurance fund's local sales oganization.

"I wonder if we're going to teach men trades in the old way," I asked the secretary of a trade association comprising more than 175 industrial plants whose employment needs he has long cared for, "I have a hunch we're due for something—"

His gray eyebrows lifted.

"You're telling me? It's going to be as different as it used to be, well—slipshod."

He reeled off a half dozen plants within a trolley-fare of his office.

Thinking in Terms of the Industry

"They've all used the same type of machinists for years and at one time or other trained apprentices. When business was good with one of them and the management in a looking ahead mood, the works manager would call in his shop superintendent and foremen and they'd map out an apprentice training program for three to five years ahead. The money would be appropriated, a classroom equipped and probably a director of training hired.

"How many to put in training was always a shot in the air. One or two took on more than their business warranted; others would have trained more if they'd been able to guess right the volume of their future business. Or they'd have taken on more at the outset if they'd been financially better fixed. But the net result was always the same—hundreds of men never completed their training and sooner or later a lot of the plants were short-handed. Everybody thought in terms of his own plant. Today they're thinking in terms of their industry. Each knows he needs what his competitors need. The drift is toward group action.

"It will mean a new deal to men who want a trade and a new day for the employers who need them. Instead of ten plants out of 150, say, in a district, each training for itself on a hit and miss schedule, they are going to pool their interests in doing the job, for all should contribute their share.

"Whether they do it in one plant or in several will depend on their equipment and location. Sometimes it may be done outside in a plant the group equips or contracts with. The where and how details don't matter. The thing is, it is going to be done by group action—through a central clearing house that will check the whole picture—the present and future demand in a given trade against the supply.

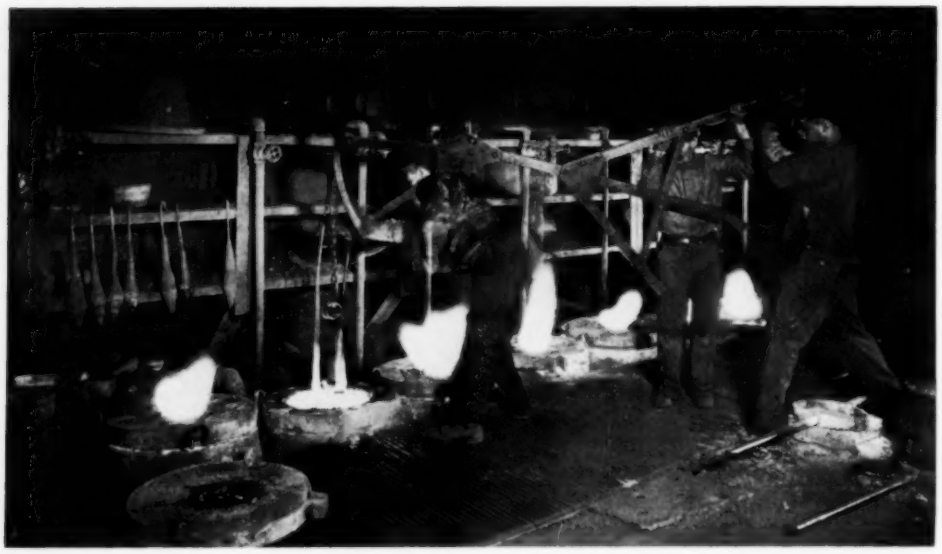
"That means two things. A given industry in a city or district will know what its existing employment needs are (*Please turn to page* 54)

Slight Increase Will Bring Need for Trained Men

FOUNDRYMEN today are finding a great need for skilled workers. Business conditions have been such during the past 5 years that little was possible in the way of active apprentice training programs. During the same period the drift of workers to other lines, as is pointed out in this interesting article, together with the natural shrinkage due to retirement and death, have resulted in a shortage of trained men that daily is becoming increasingly apparent to the industry.

During the recent A.F.A. convention in Philadelphia, E. H. Ballard, as chairman of the apprentice training session, stated that the need for trained men is greater today than ever before. He predicted that an increase of 15 per cent in operations would find foundry operators casting about frantically for men.

This interesting discussion is abstracted from an article in "Trained Men," a publication of the International Correspondence Schools, Scranton, Pa. The author is with the Department of Labor and Industry of Pennsylvania.



Pulling crucible of metal from the furnace prior to pouring —Illustration courtesy American Gas Association

Melting Control Reduces Losses

Many defects in nonferrous foundry result from improper handling of furnace operations

By N. K. B. PATCH

MELTING as a part of the process of making castings is believed by many foundrymen to be more or less a foolproof step in production. At least one would gather that impression from discussions when foundrymen get together. Importance of controlled melting of alloys cast in nonferrous foundries is so little understood as to make the success of many foundries surprising.

Such producers either are makers of castings that are of indifferent quality, or else they are lucky. Too often emphasis is laid on molding or core making as the important essential to good castings. Often the sand in the mold or core is believed to control the quality of product. It is true these are important factors in making good castings, yet little is thought about the other step in founding of metals, namely melting.

Why should the foundryman apply care, intelligence and science to the melting of his alloys? Has he not been successful in the past in making good castings by assigning the operation of his furnace to his "old trusty melter?" Have not his furnaces always worked well? Why modernize these furnaces, or change his practice or even think of melting as anything else than the way to make the metal fluid enough to pour into the mold? Melting properly is quite as important, if not more vital than molding, core making or any other step in the making of the castings.

The essential steps that require experienced intelligent control in the production of good castings are as follows:

1—Melting the metal.

2—Molding and coremaking or the preparation of the mold for the reception of the molten metal.

3—Gating the mold to insure proper flow of metal to the mold cavity.

4—Provision for feeding the casting during solidification by providing necessary risers of correct size at proper points to insure uniformity of soundness and strength.

5—Pouring metal at the proper temperature.

Each of these influences the quality of the casting and only by exacting control to insure perfection in each can the perfect casting be assured.

The first step—melting—is neglected too frequently. It often is not even thought of when a defective casting is being studied to determine the cause for the defective condition. Yet, the

best mold with all conditions perfect for a good casting can yield a good casting only when the metal is good and surely will yield a bad casting if the metal has been spoiled by improper melting.

During the melting process, metal is subjected to conditions that can affect it more than at any other time in the production of the castings. The metal becomes increasingly sensitive to the chemical action of furnace gases, as the temperature increases. These chemical actions may be used intelligently to produce valuable results, as in the bessemer converter, where the carbon and other elements are removed from the iron to make steel. On the other hand such chemical action may be detrimental, even disastrous, as when a melt is so badly misused in the furnace as to convert good metal into *scum*. Therefore, the process of melting is a vital and sensitive step in production of good castings. This is particularly true of the nonferrous metals and alloys.

Consider the chemical possibilities and effects first. When metal is liquid it easily is mixed with other fluids or gases and its chemical action is thereby accentuated, particularly if the temperature is elevated above normal. If oil and air are mixed at room temperature, the action, if any, is slow; but raise the oil temperature by ignition and the oxygen of the air combines rapidly with the oil causing a chemical action to take place evolving more heat.

Heat Increases Chemical Reactions

In many chemical actions, increase of temperature increases the chemical activity. Melting of metals subjects them to possible chemical action. With the atmosphere in the furnace, an increase in the temperature may increase the chemical activity and the longer the molten metal is exposed, the more action occurs.

Copper is refined by exposing it in a molten state to the furnace atmosphere. This is technically one of oxidation and reduction, the details of which need not be discussed here. Suffice it to say that oxidizing the metal converts certain undesirable elements into oxides as for instance iron. The iron oxide is removed in the slag, and then the molten copper is exposed to a reducing atmosphere to convert such copper oxide that has been formed back into metallic form again.

Here melting is controlled to produce an atmosphere favorable to the process of refining or melting. In the foundry we want the furnace conditions favorable to the production of good castings of the desired alloy. Therefore, the chemical action of the furnace atmosphere must not be such as to burn out any of the ingredients, unless such is provided for in the preparation of the heat of metal.

Thus too much oxygen is not desirable. In other words, an oxidizing atmosphere of sufficient intensity to be harmful is not desirable. Surplus oxygen combines with the elements to form oxides. Those having greatest affinity for oxygen are selected to oxidize first, as for example, phosphorus.

Chemical action of a reducing atmosphere in the furnace likewise is undesirable; reducing atmospheres being understood to mean those in which an insufficient amount of oxygen is present to insure complete combustion of all furnace gases. A reducing atmosphere is bad since some of the gases in such an atmosphere are dissolved by the molten metal. Later when the metal solidifies those gases are ejected, forming holes in the solid metal and in many instances developing defects that materially reduce the physical properties of the cast metal as indicated by Bolton and Weigand, *Transactions*, American Institute of Mining and Metallurgical Engineers, 1929.

To Maintain Neutral Atmosphere

Therefore, a neutral atmosphere (one neither oxidizing or reducing) would seem to be ideal. But such is not possible to secure at all times, so metallurgists have studied the problem and it seems generally agreed that a *slightly* oxidizing atmosphere is more desirable than a reducing one and such can be most easily maintained.

Therefore, it is essential to control the kind of atmosphere to which the metal is exposed. Chemists and metallurgists have determined by experiment and study that underburnt gases in the furnace are soluble in many nonferrous metals and alloys. In the paper published in 1922 by Woyski and Beck, THE FOUNDRY, July 15, 1922, the effect was described of such action on one of the commonly produced bronzes.

Many other authorities might be cited to prove such action may occur when these nonferrous alloys or metals are exposed to such atmospheres while molten. But admitting that this action does occur, what should the foundryman do to protect himself against damage to his melt from this chemical action?

First, keep the atmosphere in the furnace as inactive or inert as possible. This is accomplished by an adequate supply of oxygen to burn completely all combustibles in the atmosphere, yet using precaution not to overdo the supply of oxygen.

Second, subject the alloy or metal to this atmosphere for the minimum length of time.

An interesting fact in connection with these requirements is that the more complete the combustion, as required by the first condition, the hotter the furnace becomes and consequently the shorter the time required, as called for in the second requirement, provided that the air supply is not so much in excess of that needed for complete combustion as to cool the atmosphere down.

Therefore, when the furnace atmosphere is controlled intelligently (*Please turn to page* 56)

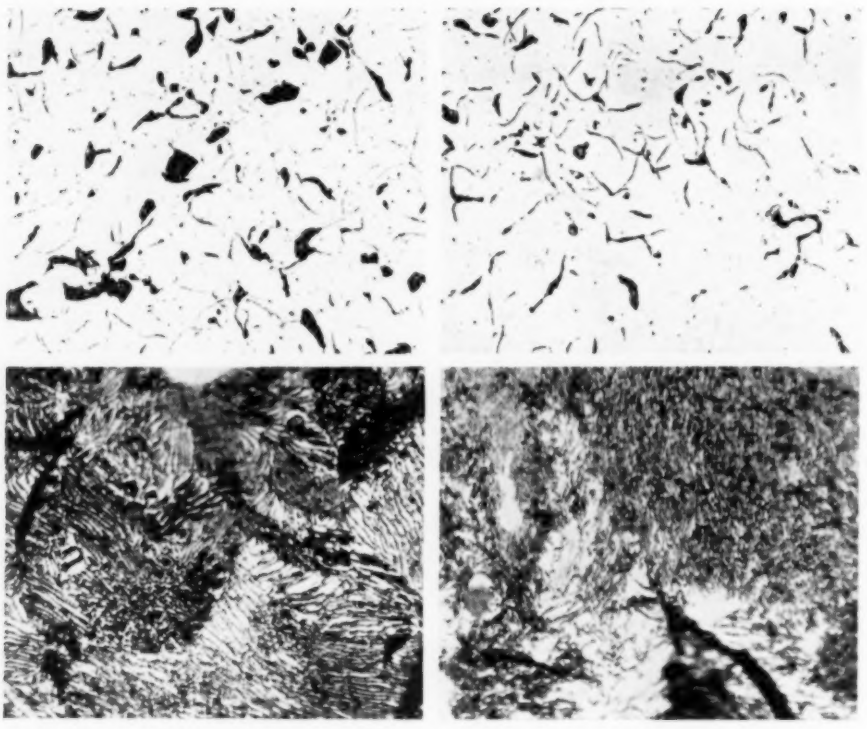


Fig. 1 (Upper Left)—Plain iron, unetched, X100. Fig. 2 (Upper Right)—Molybdenum iron, unetched, X100. Fig. 3 (Lower Left)—Plain iron, etched, X500. Fig. 4 (Lower Right)—Molybdenum iron, etched, X500

Molybdenum in Gray Cast Iron

Numerous applications for alloy developed in foundry field during past five years

By C. M. LOBE JR.
Climax Molybdenum Co., New York

DURING the past 5 years the use of molybdenum in cast iron has grown from a metallurgical curiosity to commercial applications of large and still growing proportions. That alloy has proved itself an economical addition to alloyed and formerly unalloyed gray iron. The saving is either in actual cost of alloys, or by reducing the number of rejects or scrapped castings.

Molybdenum additions increase the tensile and transverse strengths—usually increasing the deflection at the same time. Figs. 1 to 4 show the effect of that alloy on the microstructure of cast iron. The refining of graphite, and sorbitization of the matrix is evident from the illustrations. Fig. 6 shows the fracture of two arbitration bars, the one on the left being the base iron, the other being the same iron with molybdenum added in relatively small amount.

Molybdenum not only is effective alone, but produces improved iron when alloyed with nickel or chromium, or both. When high physical properties are required, with not too much emphasis on machining qualities, a chromium-molybdenum iron is a cheap combination of alloys to produce results. When no improvement in machinability is necessary, but higher physical properties than the unalloyed iron are required, a plain molybdenum iron may be used. Nickel, added to a molybdenum iron, with a lowered silicon to neutralize the graphitizing action of nickel, will produce strong irons that are commercially machinable at hardnesses as high as 293 brinell.

Molybdenum has a strong effect upon growth resistance and high temperature strength in iron. Gray iron alloyed with that material has been found to machine better than an unalloyed iron of the same brinell. Molybdenum iron wears better than unalloyed iron, due to the uniformity throughout the casting, and to the inherent

toughness of the iron. Naturally, for an iron of any particular wear resistance, the life is dependent upon how far a part may *wear* away before it *breaks*. Molybdenum intensifies the action of other alloys in iron, and often is added to a chrome-nickel iron to improve its properties.

Molybdenum has a strong tendency to produce a uniform iron throughout large sections, and in widely varying sections. When making a casting with only heavy sections, it often is possible to adjust the mixture in the cupola so that the proper iron will come down, but, producing a casting with both thin and heavy sections may cause either chilling in the thin sections, or porosity in the heavy parts.

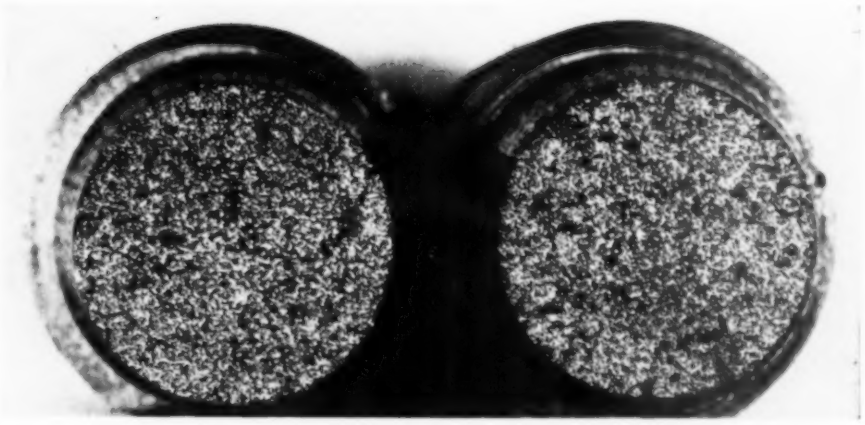


Fig. 6—Fractures of two arbitration bars. The one on the left being the base iron and the one on the right containing molybdenum

It is well known that the production of high test iron by lowering the total carbon and silicon contents, and possibly adding nickel to replace some of the silicon, causes an iron to shrink. The shrinkage usually can be eliminated by raising the carbon and silicon. The only disadvantage is the resultant open grain. Molybdenum will close this grain, and therefore, although indirectly, one can understand how molybdenum can be used to eliminate shrinkage.

Use of molybdenum should not be misunderstood. It is not a panacea for all ills; it will not make a bad iron good, although it will improve it to some extent. It can be used where there is no need for it; and too much molybdenum will cause machining difficulties.

Good molding and melting practice always will be a prerequisite in the production of high grade iron. Even shrinkage often can be eliminated in an unalloyed iron, with co-operation between the pattern maker, designer and foundryman.

Fig. 5—Tuyere and grate bar castings containing small amounts of molybdenum

But there are parts made of cast iron which, because of over-all weight limits, space in a machine, or other engineering limitations, require the production of a casting intrinsically difficult to feed. In this case a high-carbon, high-silicon iron with a molybdenum addition will give the proper pouring and solidification characteristics with a resultant close-grained casting.

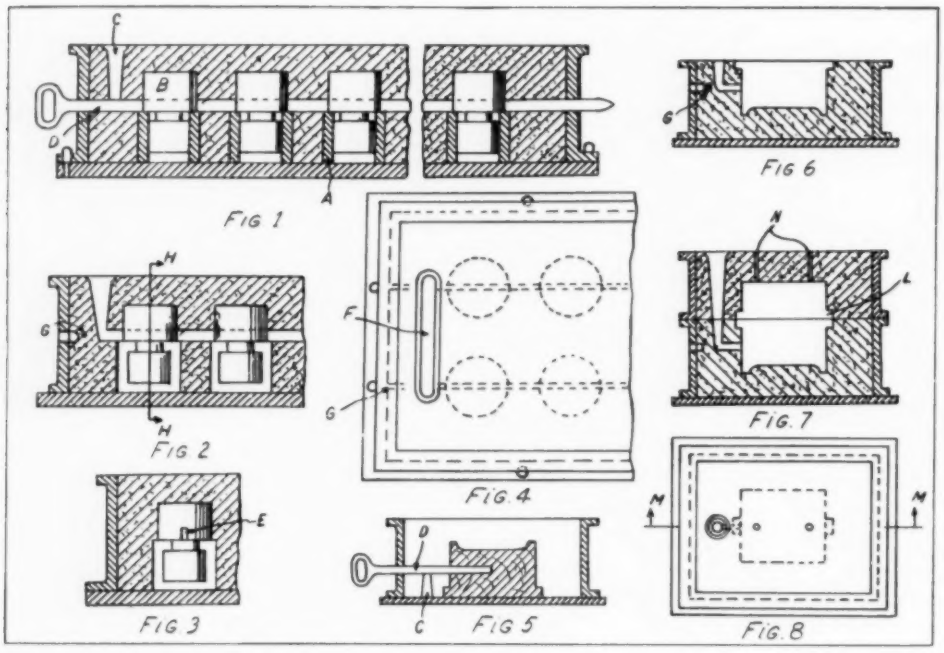
Foundrymen often add molybdenum in amounts of around 0.25 per cent to castings in which they are encountering cracking in the mold. The property of molybdenum to toughen iron, even when it is still hot, is especially valuable to producers of malleable iron, when the hard iron casting has a strong tendency to crack on cooling.

Molybdenum is added easily in the spout or ladle in the form of ferromolybdenum, the alloy going into solution in the iron almost instantly. There is no need to melt the ferromolybdenum—it dissolves like salt in water. Its advantage in this relation is the ability of a jobbing foundryman to use the same base mix all day, varying the properties of the iron for different sections and castings by the addition of proper amounts of the alloys.

The accompanying table shows the effect of molybdenum on three types of commercial iron. A brief summary of the commercial uses of molybdenum would include the following: Gears, flywheels, valves, hot water heaters, pulleys, frames for machine tools, and other large frames, cylinder liners, roaster rabbles, roaster arms, lead pots, slag pots, dies, cylinder blocks, cylinder heads, exhaust manifolds, clutches, brakedrums, pistons, rolls, rod mill guides, chills, stoker parts, bottle molds and ingot molds.

Due to its effect in toughening the carbides in white iron, at the same time refining the grain and hardening the iron, molybdenum is extending its field in its application to parts subjected to excessive wear. White iron containing molybdenum is going into service where ordinary white iron has been too brittle.

From 0.25 to 0.50 per (*Please turn to page* 59)



Figs. 1 to 4—Sectional and plan views showing application of special gate in mold containing two rows of cored tappets. Figs. 5 to 8—Showing method of applying gate below joint line to mold, typical of wide miscellaneous class of molds

Pour Through Multiple System

Horizontal gate does away with necessity of placing a separate cope on the mold

THE accompanying illustrations depict a gating system developed by C. M. Bolich, Nickel Plate Foundry Co., Cleveland. The method provides for making a combined runner and gate at the most advantageous location by a drawing operation through the ends or sides of the mold and flask, if a flask is employed. This method avoids the need of gating a mold at the parting line. The gate may be placed at the most desirable level in view of the nature of the casting or castings. In this manner the most advantageous flow of the metal may be had for the best castings, irrespective of the parting line. The lifting effect of the molten metal is reduced, fins are eliminated, runouts are guarded against and other beneficial effects secured by using this type of gating system.

In many situations a single half flask serves the purpose for which a cope and drag ordinarily would be necessary. It is claimed the method is particularly advantageous where a large number of small castings are made in a mold. The accompanying illustrations, Figs. 1 to 8, cover one of the various mechanical forms in which the principle may be applied.

The method is most conveniently illustrated in the half flask mold for automobile valve tappets 1½ inches high, 1-inch diameter, hollow, closed at one end and with an internal flange at the upper or open end. However, it is claimed the method also is applicable to the production of a great variety of comparatively small castings, whether similar in shape and distribution of the

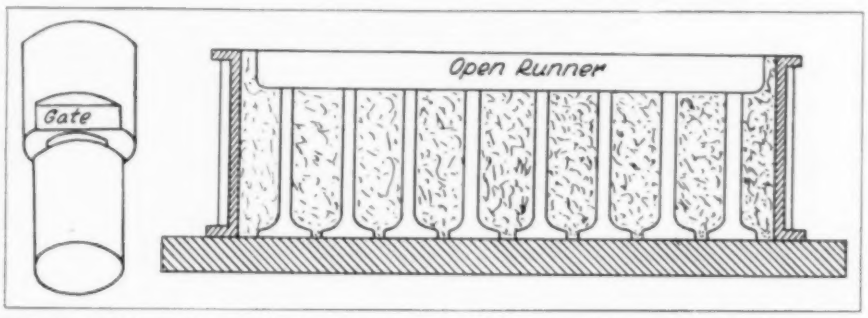


Fig. 9 (Left)—Gate cavity is formed at one side instead of through the center of the core as shown in Figs. 1 to 4. Fig. 10 (Right)—An open runner on top conducts the metal to the vertical mold cavities. No cope required

metal, or, for making castings of considerably different characteristics.

In the application of the method to a cope and drag mold Fig. 7, the metal is introduced near the bottom of the mold to prevent it from falling with great force in the flange at the bottom, and also to eliminate fins at the parting line where the trunnions are located.

Fig. 1 shows a mold in the flask with pattern plate, patterns *A*, core *B*, sprue or pouring basin form *C* and gate bar *D* all in place and with the sand rammed. Each core contains a narrow passage, shown at *E* Fig. 3. The gate bar *D* as shown in Fig. 1 is inserted through a suitable opening in one side or one end of the flask and extends a short distance beyond a corresponding opening in the opposite end or side. In its passage it passes through the opening in each core, so that in a manner of speaking the cores are threaded on the gate bar as beads are threaded on a string. The bottom edge of the gate bar also rests on the top of the patterns. Thus when it is withdrawn through the end of the flask it leaves a continuous gate or passage for the metal to enter each of the mold cavities. No cope is necessary since the one part flask serves for both cope and drag.

Cores Project Above Patterns

The prepared cores are placed in the hollow patterns and after the gate bar has been adjusted in place, the flask is filled with sand, jolted, squeezed and struck off in the usual manner. The pattern plate is lowered away from the mold taking the patterns with it, but leaving the cores suspended in the molds. The gate bar is withdrawn, also the sprue pin and a jet of air is blown through the gate passages to remove any loose sand. The mold then is removed from the machine and placed on a flat iron plate which

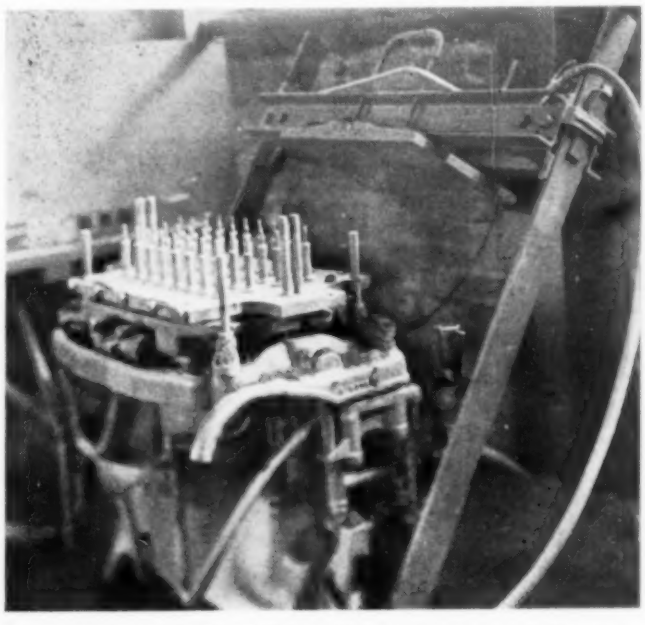


Fig. 11—Plate with 32 tappet patterns is mounted on a jolt squeeze machine

Fig. 12—The one piece molds containing runners and mold cavities are placed on machined cast iron plates which serve as drags

serves as a drag and which imparts the necessary chill to the face of the tappet castings when they are poured. The gate openings in the flask are plugged with small sand slugs.

On these particular castings it has been found that the gate passage on one side of the core as shown in Fig. 9 presents certain advantages over the gate already described, that is the gate passage through the center of the core. Either type of gate is satisfactory as a gate but the advantage lies with the side gate in that the cores may be made more rapidly. The extra motions involved in setting and removing the gate piece from the center gate corebox, are eliminated in a side gate corebox where a small projection in the corebox automatically forms the gate cavity. Exact detail of number, position, direction and inclination of the runners depend on circumstances, following good foundry practice of giving the molten metal as short a distance as possible to flow.

Adapted to Any Mold

Application of this type of gating in the ordinary mold made up of the usual cope and drag is shown in Figs. 5 to 8. Fig. 5 is a section on the line *M M*, Fig. 8, with the pattern plate, pattern, gate bar *D* and sprue *C* all in place in an inverted drag. In this instance the gate bar *D* is held in place by an opening in the side of the flask and by the corresponding slot in the side of the pattern. Fig. 6 shows the drag rolled over, with pattern, gate and sprue pin removed and in condition to receive the cope. The gate passage between the sprue and flask is closed with a sand slug.

The cope, made in the usual manner, is shown in place on the drag in Fig. 7. The sprue in the cope coincides with and forms a continuation of the sprue in the drag. As in the first instance the details of sprues, (*Please turn to page* 56)

Fig. 1 — Cores are examined minutely and gaged with the greatest accuracy during the assembling process

Hold Cores To Close Tolerances

Extreme accuracy is so essential that the coreboxes become obselete in about a year

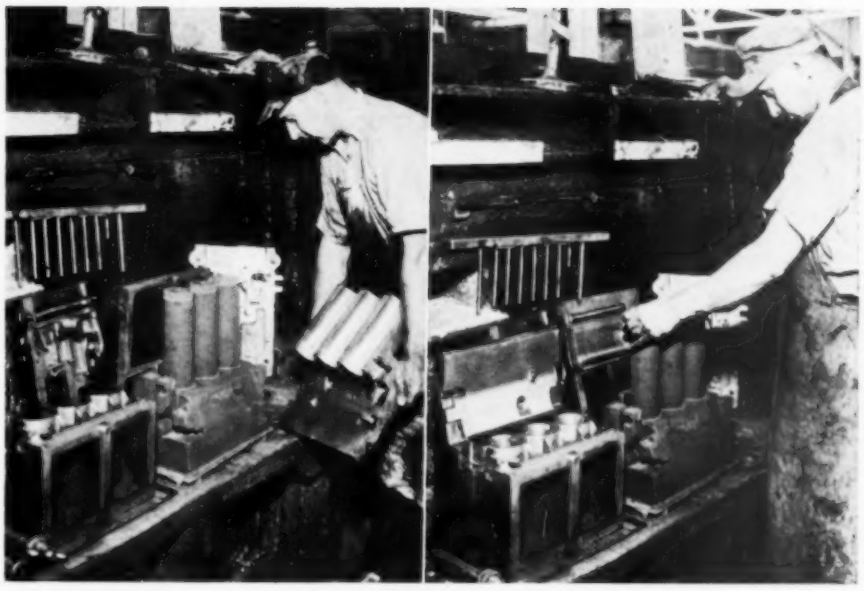
By PAT DWYER

COREMAKING departments in the Chevrolet gray iron foundry, Saginaw, Mich., are located, one on the north and the other on the south side of the main building. The core room on the south side is devoted almost exclusively to the production of cylinder cores, while a wide variety of miscellaneous cores is made in the core room on the north side. This arrangement reduces the distance the cores have to be carried to the respective molding units. Each core room, 136 feet in width, extends the full length of the building, 456 feet. Combined floor area of both departments is 124,032 feet or approximately 5000 square feet less than the area devoted to molding and casting activities. Full length windows in the side wall supplemented by windows in the roof furnish ample light and ventilation. Artificial illumination is provided for night work in this plant where operation continues through the entire 24 hours.

With the exception of the coremaking machines and certain special devices peculiar to each department, the equipment, layout and methods of operation are the same in each department, therefore a general description of one will serve for both. The sand is prepared at the east end and trucked to the various coremaking stations in the vicinity. Green cores are placed on racks and carried by lift truck to the ovens located approximately in the center of the core room. Dried cores are removed from the ovens in a similar manner and deposited still further west in the vicinity of the assembling and inspection benches and thence to the storage racks. From that point they are taken to the various molding units as required by operating schedule.

Fig. 2—The valve housing core is anchored in place with molten lead

Sand mixing equipment includes one muller type machine in which the mixing action takes place under a pair of revolving rollers in a stationary pan, and four paddle type machines in which the sand is agitated and thrown from end to end of a trough by a number of revolving paddles attached to a horizontal shaft. Sand from covered storage bins on the outside falls through chutes in the wall. Each mixer is equipped with a loader in which a measured volume of sand is lifted and deposited in the mixer.



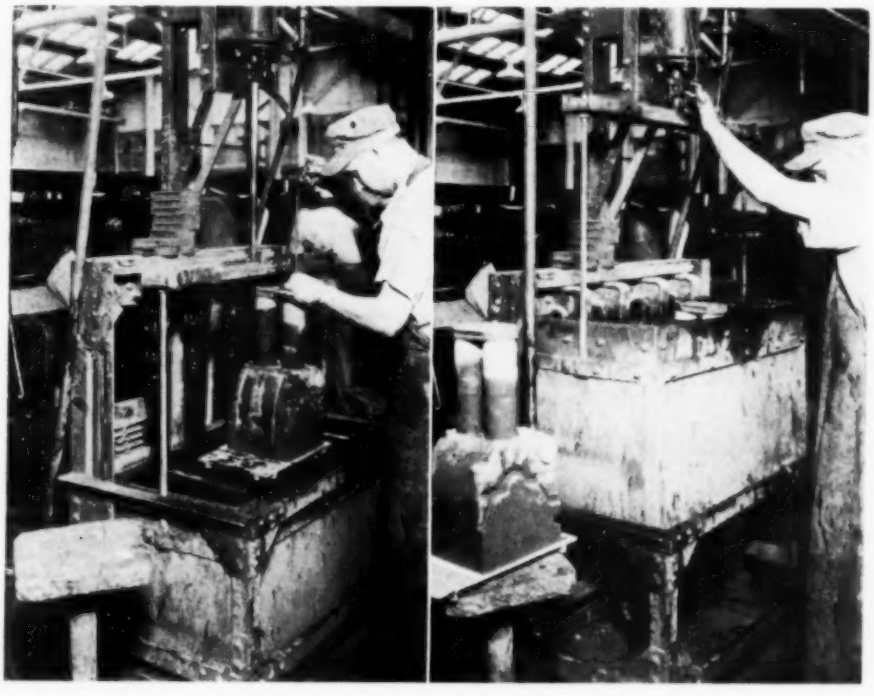
Figs. 5 and 6 — The corebox for the body and barrels is in several sections to facilitate removal

Core sand is prepared according to two standard formulas. One contains 100 parts lake sand, 100 parts bank sand, 3 parts oil and 3 parts of a proprietary cereal binder. The second mixture is made up exclusively of lake sand bonded with oil in the proportion of 1 part oil to 55 parts sand.

The first mixture is used for the body cores in the cylinders, that is the cores which form the inside of the crankcase and the interior of the barrels. The bank sand supplies the green bond which prevents the cores from sagging or otherwise losing shape while in the green state. Incidentally, a third mixture made up almost entirely from reclaimed molding sand is used in the crankcase section of the body cores.

While all the sand is fairly dry as it comes from the bins, extra precautions are taken with sand for the water jacket cores. Before entering the mixer this fine grade of lake sand passes through a heated revolving drum where the last traces of moisture are expelled. Measuring devices located above each mixing unit deliver the required volume of oil and water for each batch. These liquids are sprayed over the sand while it is in motion.

Flat plates serve on the body cores and many of the smaller cores, but in a great many instances dryer shells are necessary to support cores of irregular shape while in the green state. These thin dryer shells are flanged and ribbed to insure rigidity under fluctuating temperatures and are provided with vent holes to permit steam to escape, to hasten the drying time and to prevent sand from sticking to the face. An immense stock of these dryer shells has to be maintained by this organization to meet the daily requirements of the coremakers on the bench, in transit and in the ovens.



Figs. 3 and 4 — Two stages in the process of applying liquid blacking to the face of the cylinder body and barrel cores

Many of the smaller cores are rammed by hand, or in a battery of three coreblowing machines, but the greater number are made in small rollover machines located close to the walls on either side of the core room. A small bench near each machine constantly is replenished with a supply of sand, and if necessary, with wires, chills, or other accessories. Attendants remove the cores as fast as

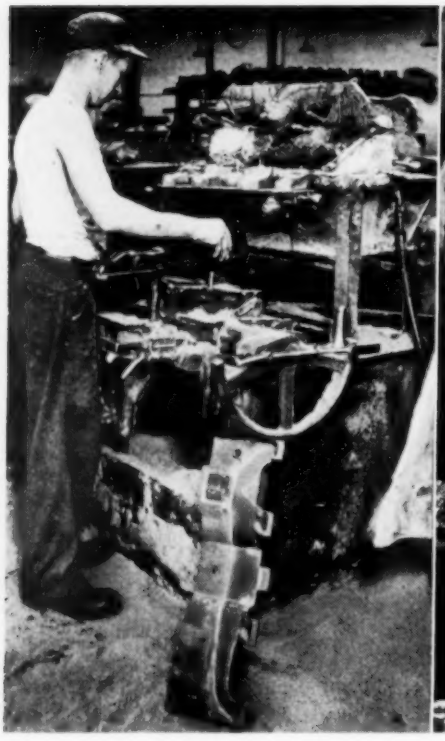


Fig. 7 (Left) — Metal dryer shells are employed on manifold cores and others of irregular contour. Fig. 8 (Right) — Strainer cores are made in a stripping plate multiple corebox

they are made and load them on racks in the vicinity. A lift truck takes the loaded racks to the ovens and brings empty racks back from the core storage section. With perfectly fitting coreboxes, standardized practice and with definite guides for the location of reinforcement and vent wires, operators rapidly acquire a remarkable degree of manual skill and dexterity. This feature, of course, applies to all operators in the plant where performance is set to a rapid tempo and where combined activities must synchronize accurately. To a certain extent performance may be compared to that of a giant orchestra, with the exception that there are no featured solo parts. All work together.

Each of the core departments is equipped with a battery of 64 ovens in two groups of 32 where 16 ovens in line are separated from a similar line by a dividing wall. Each oven is 6½ feet wide, 7 feet high and 12 feet in length to accommodate two core racks. In the new section of the foundry ovens are fired with fuel oil, while in the original installation ovens are fired with coke from both ends in a basement which extends under the entire center of the core room.

Each firing chamber is connected to a single flue that extends under a group of eight ovens and terminates in a stack projecting through the roof. Two openings from the flue through the floor of each oven are controlled by dampers operated by chains on the outside. Two outlets for the steam and gas are provided in the side wall, one near the top and the other below the floor level. A pyrometer is attached to each oven to keep a record of heat fluctuations.

Ovens never are open more than a fraction of a minute either for depositing loaded racks of green cores, or for snatching out racks of dried cores. It is claimed that the firing pit, flues and draft facilities are so efficient that no more coke is consumed in firing a battery of 8 ovens than is consumed in firing a single oven where careless and inefficient construction and methods obtain. A temperature of approximately 400 degrees Fahr., is maintained constantly. Baking time for the cores, depending on shape and bulk, ranges from 1 to 3 hours. (*Please turn to page* 60)

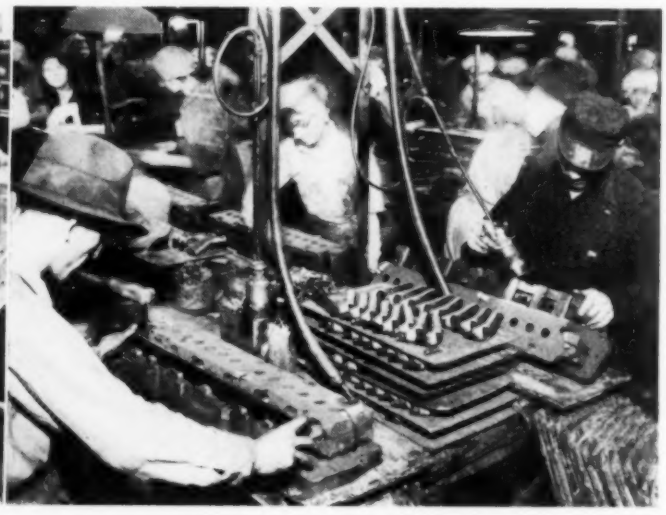


Fig. 9 (Left)—Holes in the end and special bearings in the corebox support the vent wires. Fig. 10 (Right) — Extremely accurate gages are applied at every step in the assembling of the cores

System Saves Money on Supplies

Notable economies are effected where the foreman realizes cost of various items

By D. H. TYSON

United States Pipe & Foundry Co.

DURING the past months the word economy has been mentioned more frequently than for the past decade. Presidents, business men generally, politicians—all have talked economy. We should be lacking in a proper sense of sarcastic humor if we did not breathe a hope that the presidents and business men have met with greater success than the politicians in practicing their preachments.

Admitting the sincerity of management in demanding efficient operation, it is not enough for them to talk economy or for them alone to practice it. Without the closest co-operation of every foreman or other supervisors in the organization, the senior executives can effect little saving. This does not apply to questions of general management or company policy, decreasing rates of pay, reducing hours of operation etc. which come within the purview of the senior executives only, but rather the more or less routine running of a plant that, in the final analysis, operates in its intimate details under the direct supervision of a foreman or labor boss.

Foreman Must Watch Costs

Upon the foreman falls the responsibility for proper output, both as to quantity and quality. His success is judged upon these two principal bases, coupled with the unavoidable and essential additional one of cost.

Much has been written and said about the proper control of raw materials. Standards have been set and gratifying results obtained from an exhaustive study of the reasons for variations from standard. Modern business has realized that information or knowledge is the keynote of successful control and great strides have been taken in imparting cost data to foremen for their guidance. Reports are compiled regularly, but usually they deal with production figures almost exclusively, some emphasis being given to bad product ratios and the cost of these losses.

We find reports on the number of men, raw materials analyses and some tabulations of repair and maintenance cost. Importance and usefulness of these figures is obvious, but insufficient attenion is paid to the cost of miscellaneous, day to day, supplies that can be likened, in their effect upon profits, to the constant dripping of water that ultimately wears away the stone. Shop supplies form part of the overhead. They are not materials directly chargeable to the specific saleable job and as a consequence they are accepted as an inevitable expense—just a necessary evil that helps to swell burden costs.

For example, consider cotton waste. It is cheap. The average workman thinks—if he thinks at all—that it costs little or nothing. In many plants waste is issued by the bale from the storehouse upon receipt of a requisition. The immediate need for cotton waste may be 10 pounds or less but a bale is ordered and out it goes, to lie around and be grabbed at by every man in the shop. Much, if not most of it is wasted. All the foreman has to do is sign a requisition and up comes another bale.

Requisitions Issued Carelessly

In a more strictly controlled plant, the foregoing procedure would be regarded as almost criminal in its potential wastefulness. Only quantities for immediate use can be requisitioned and the storekeeper receives many demands for small quantities from each department. Where the point is not stressed the average requisition-signing foreman has at best, but a vague idea of how much expense he has incurred for such an apparently insignificant thing as cotton waste, or other store items including hack saw blades, oil, grease, lumber, nails, nuts and bolts, screws, emery wheels, bar iron for the blacksmith shop, glue for the pattern shop and so on almost *ad infinitum*.

If information is the basis of all economy schemes, then every foreman or other employe authorized to sign requisitions for supplies should be advised regularly of the cost of the stores consumed in his department and should be given a schedule showing how much he spent for each separate com- (*Please turn to page* 64)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

To Make Up Cupola Charges with Structural Steel

We produce a considerable amount of scrap in our structural shop and are thinking of using this material as a substitute for pig iron in the cupola charge. In this manner we could control the sulphur and phosphorus content more closely in the castings. We assume that we could regulate the manganese and silicon content by adding these elements. Some of the steel is rusted considerably and we are wondering if this rust would result in oxidized metal. What is the analysis of bessemer and open hearth steel rolled in plates and structural shapes?

Scrap steel from structural shops is used in many foundries as part of the cupola charge but we know of no place where it is used entirely as a substitute for pig iron, with the single exception perhaps of plants engaged in the production of hard or white iron castings. Due to the low carbon content—0.08 to 0.15 per cent—and the practically entire absence of silicon the metal cannot be used for the general run of gray iron castings. However, as you surmise, the metal can be rendered machinable by suitable additions of silicon and manganese.

The problem in your case really is one of economics, the cost of your present pig and scrap charge as compared with the cost of steel scrap plus the cost of the additions. Also with the steel scrap you will have to watch the cupola operation more closely and will have to use more coke to secure hot, fluid metal at the spout. Whether made by the bessemer or open hearth process structural shapes and plates conform to the following approximate analysis: Carbon 0.08-0.15 per cent, silicon 0.25 per cent maximum, phosphorus 0.10 maximum, sulphur 0.05 per cent, manganese 0.35-0.50 per cent. In the cupola the metal absorbs from 2 to 3 per cent carbon from the coke and in the absence of silicon this carbon remains in the combined form. Under ordinary conditions where the rusty scrap forms part of a pig iron and scrap charge, the rust either burns away or is absorbed in the slag.

Will Operate Cupola To Secure High Carbon in Iron

We shall appreciate your opinion on the best method of operating a cupola to obtain the maximum amount of carbon.

A high bed and intermittent tapping permits the metal more time to absorb carbon from the fuel. Excess amount of air must be avoided, although sufficient volume must be provided to secure hot iron. Some pig irons contain more carbon than others. In pig iron, as a rule, the lower the silicon, the higher the carbon. This naturally introduces another factor into the problem, since the analysis of any iron produced in the foundry must conform to the analysis desired in the castings. Mild blast, heavy coke ratio, reactive soft coke, high carbon content in the charge, all help in securing high carbon in the resulting iron. However, you cannot get much over the eutectic percentage in any case.

Alloy for Pistons Is Not Suitable for Aluminum Patterns

Can you supply us with information on an aluminum alloy which is used for making pistons? We do not want it for pistons, but for making aluminum patterns and core boxes.

Most aluminum pistons are made in permanent molds, the alloys used being developed for that particular process. Consequently, the properties obtained in sand castings may not show up as well as when the castings are made in permanent molds. One alloy that is being used successfully for permanent mold pistons contains 87 to 88 per

cent aluminum, 9.25 to 10.75 per cent copper, 0.90 to 1.50 per cent iron, and 0.15 to 0.35 per cent magnesium. A similar alloy without the iron also is used. The latest addition to that field is one claimed to have a much lower coefficient of expansion. The alloy contains 14 per cent silicon, 2.5 per cent nickel, 1 per cent magnesium, 1 per cent iron, and 0.9 per cent copper and usually is heat treated to obtain the best physical properties.

Since these alloys are used for permanent mold casting, and we believe that you will obtain better results by trying some other aluminum alloy for your pattern work. It is suggested that you make some castings of an aluminum alloy containing 5 per cent silicon. It is resistant to corrosion, somewhat plastic in that it can be hammered or peined without breaking, is fluid when molten and can be cast easily.

Stop Tin Sweat by Reducing Pouring Temperature

We have been troubled with tin sweat through risers or sink heads on thick bronze castings. A separation of metal high in tin and lead appears to come up through the top risers when the metal begins to congeal.

Tin sweat, as it generally is known, usually appears as light colored exudation which seems to be squeezed out of the metal during solidification. Analyses of those exudations or bright beads of tin sweat by various investigators indicate that they are much higher in tin and phosphorus than the remainder of the metal. The composition is such that the tin sweat is the last component to solidify, and the contraction of the body of metal tends to force it out to the surface although those beads have been found in interior cavities.

The cure for the trouble in many cases is to reduce the pouring temperature so that the interval from the liquid to the beginning of solidification is not so great, and that will militate against the formation of the high tin-high phosphorus component. Rapid cooling through the use of metal molds also will decrease the tendency toward formation of tin sweat.

Some Batches of Grate Bars Burn Too Rapidly in Service

We make grate bars weighing from 100 to 150 pounds. Some batches burn out much more rapidly than others of apparently the same material. Have you any theory to account for this?

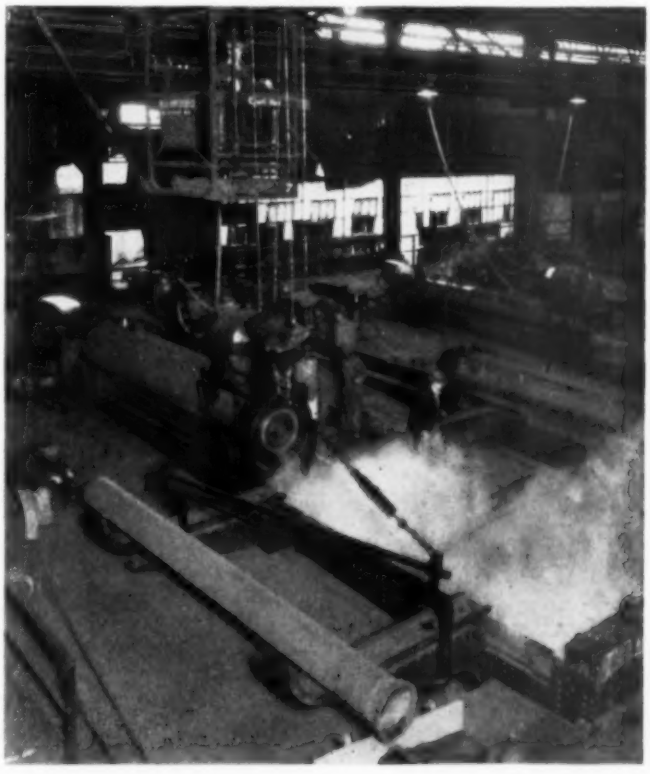
Two plausible theories may account for this peculiar phenomenon. The first is that the various batches are *not* made from the same material. The second is that the bars do not receive the same treatment in service. Since the bars vary in weight between 100 and 150 pounds, a third theory—rather remote it is true—presents itself. That is that the design of one style of bar is not as good as the other.

Basing our opinion on experience we are inclined to favor the first theory. The greater part of the cupola charge for the grate bars probably is made up of miscellaneous iron scrap. Composition of this scrap may vary to an almost infinite extent. Grate bars are subjected to exceedingly severe service and the composition of the iron entering the molds should be checked carefully. The ideal analysis for these castings is approximately: Silicon 1.75 per cent; sulphur 0.06 per cent; phosphorus under 0.20 per cent; manganese 0.70 per cent; total carbon 3.25 per cent or less. The phosphorus and carbon may be lowered appreciably by the addition of steel scrap to the cupola charge.

Annealing Pots Made From Regular White Iron Mixture

We manufacture gray iron and malleable fittings and are contemplating the manufacture of annealing pots in our own foundry. We shall appreciate information on the best mixture to use in these castings.

Many factors besides the composition affect the active life of an annealing pot and for that reason the foundryman sometimes is at a loss to determine whether he is serving his own interest better by making his own pots, or by buying



them from an outside interest which specializes in these castings.

Where the pot is properly designed, loaded, fired and cooled, fairly satisfactory results are secured from pots poured from the regular white iron cupola mixture of the following approximate analysis: Carbon 3.00 per cent; silicon 0.70 to 1.00 per cent; manganest 0.30 per cent; phosphorus under 0.20 per cent; sulphur 0.15 per cent. Average life of these pots is 10 to 12 heats.

At one time all malleable foundries made their own pots, but in recent years the majority have abandoned this practice and order the pots from manufacturers who specialize in their manufacture and who have developed mixtures that insures maximum life.

Melt Aluminum in Coated Cast Iron Pot

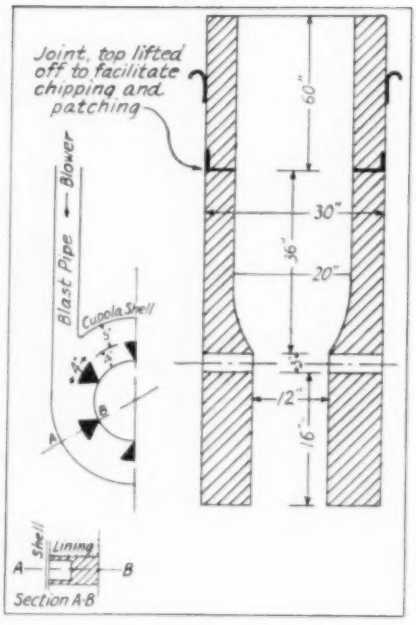
We would like to melt aluminum at 1400 degrees Fahr. Do you think a cast iron pot will stand up under these conditions and would there be any reaction on the pot in melting aluminum at that temperature?

As far as we know, cast iron pots are preferred for melting aluminum in units where the metal is indirectly heated. They may or may not contain chromium depending upon whether the customer is willing to pay the additional cost for obtaining a more heat resistant pot. Molten aluminum will dissolve iron. To keep the iron content in the metal low it is necessary to melt fast, and not leave it in the pot longer than necessary. According to data available, molten aluminum dissolves 0.10 per cent iron from a pot per hour.

Much trouble from solution of iron from the pot by molten aluminum can be eliminated by seeing that the interiors of the pots are coated with thin solutions of lime or whiting containing some water glass. That is painted over the pot interior while it is at say around 500 degrees Fahr., and as may be expected, the coating dries almost instantly. Coating the pot should be done two or three times a week depending on how it stands up. Before recoating, the interior of the pot should be scraped clean and should be free from dross. Above all see that the coating used is a thin solution, and apply two thin coats rather than one thick one which has a tendency to peel and leave the surface exposed to the action of the molten aluminum alloy.

Small Cupola Is Built with Bosh Lining

The small cupola shown in the accompanying sketch has been designed for handling small heats of approximately 1000 pounds of gray iron. I shall appreciate your opinion on the merits or demerits of the idea.



Continuous tuyere extends around the cupola inside the shell

The boshed type of cupola as opposed to the straight lining type has been tried at various times over a long period. In recent years the boshed type has been adopted in the automobile industry where the cupola is in constant use throughout the entire day. It is claimed that the tendency toward bridging is reduced and that the lining does not burn back to the same extent as in a straight lining.

These factors are relatively unimportant in a small cupola where the total operating time is limited to about one hour. With blast control, the lining will not burn to any appreciable extent in that time.

Due to the small diameter at the tuyere line, 12 inches as shown in the illustration, we believe that the continuous tuyere will not prove as efficacious as two or three individual tuyeres, say 2½ x 4 inches. Blast entering through a complete circle will have a tendency to chill the coke in the vicinity. Even in large cupolas it has been found advisable at times to close a tuyere here and there until the coke immediately in front burns up brightly.

We have seen no record of a small cupola with continuous tuyeres, but successful installations employing two or three small tuyeres have been described in THE FOUNDRY on many occasions. The most recent is described in the August, 1933 issue. In this instance the cupola shell is made up of two discarded oil drums, lined at the melting zone with a mixture of 5 parts carborundum fire sand and 1 part fire clay. That mixture is rammed around a 12 inch diameter wood plug. The lining below and above the melting one is lined with brick in the usual manner. Blast is admitted through two diametrically opposite tuyeres 2-¼ x 4 inches. This cupola has a melting capacity of 1000 pounds per hour, and it is claimed that after 10 heats the lining had burned back only about ½ inch. However, your design presents ingenious features and may prove that some existing ideas on cupolas need to be revised.

Large Roll Shell Casting Shows Shrinkage

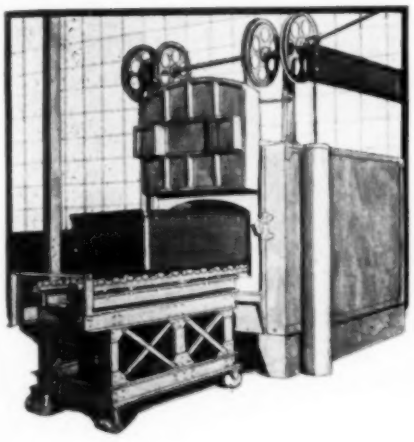
We are having shrinkage trouble with a roll shell casting 42 inches inside diameter, 55 inches outside diameter and 20-inch face. We cast about an 8-inch head on them. The metal is melted in an electric furnace and poured as cold as possible. The mold is made in cores, gated on top and poured on a revolving table. Recently we have read that silico-manganese will prevent shrinkage. How much should be added per ton of metal? It is used in place of manganese?

If the statement that you cast an 8-inch head on the roll shell means that you extended the mold cavity to a height of 28 inches, we are at a loss to understand why the casting proper should show any shrinkage cavity after the head ring was removed. Even if the metal was poured in a stationary mold, a head of this kind should prevent the formation of any shrinkage cavity in the casting. A rapidly revolving mold should produce a solid casting without any head. In fact, centrifugally poured castings invariably show a denser and more solid structure than castings poured in the ordinary manner in stationary molds.

The possibility exists that by an 8-inch head you mean that you had an 8-inch riser at some point on the top of the casting. The possibility also exists that the mold was revolving at slow speed. Manifestly one or even two 8-inch risers will not feed a casting 55 inches in diameter, 6½ inches thick and weighing approximately 5100 pounds. It is equally apparent that the mold must be revolved at high speed if the metal is to be affected by the centrifugal action.

A solid casting may be secured in a stationary mold by placing six or eight 10-inch diameter risers 12 inches high on top of the casting, or by expanding the casting 2 or 3 inches above the 20 inch mark and then carrying that ring to a height of 10 or 12 inches. By revolving the mold at high speed a solid casting may be secured without the use of any risers. Silico-manganese is a highly concentrated combination of silicon and manganese, and the amount used in any given mixture will depend on the percentage of these elements already in the metal, and the percentage required in the casting.

Viewing Foundry Developments



At Short Range

IN A prominent valve manufacturing plant two-part valve cores are assembled and dried in sand forms instead of the usual metal forms or the occasional makeshift devices. A small wood frame is placed around one of the patterns and packed with core sand. This block of sand is dried, a replica of the drag half of a mold with the prints in the proper position. The first part of the two-part core is placed in this form. A little paste is applied to the connecting member and the second part of the core is located in place where it is established accurately in the prints. The core then is given a supplementary drying in the oven.

• • •

PEARLITIC structure cast iron can be obtained from a composition containing 0.01 to 5.0 per cent nickel; 0.01 to 2.0 per cent molybdenum; 1.75 to 3.75 per cent carbon; 0.5 to 3.0 per cent silicon, and 0.25 to 2.0 per cent manganese if superheated over 2550 degrees Fahr. before pouring, according to a recent patent. The mixture also may contain from 0.10 to 2.0 per cent chromium. The iron is said to possess great strength, moderate brinell hardness, uniform structure, resistance to wear and abrasion, and stability of structure at elevated temperature. It also can be heat treated to obtain specific properties.

• • •

In a prominent Mid-West foundry high strength iron with low carbon content is secured by melting the iron in a cupola. Part of the molten metal then is blown in a bessemer converter and added to the metal in the ladle. Proportions may be varied to meet special requirements. The usual combination is 60 per cent gray iron and 40 per cent steel from the converter.

• • •

Immense size of the QUEEN MARY, new Cunard White Star superliner, may be conveyed by the main hull casting, comprising the four shaft brackets, the stern post, and the rudder stock and frame. The total weight of that group of castings approaches 600 tons.

• • •

A protective oxide, similar to that formed on aluminum by natural processes when the surface comes in contact with the air, but many times thicker, may be obtained by artificial means known as the Alumilite process. Metal to be treated is placed in a sulphuric acid bath of special composition through which a current is passed. The oxide coating is ordinarily translucent and does not conceal the natural metallic lustre of the metal. Coatings produced may be highly resistant to corrosion and abrasion.

• • •

NICKEL iron castings are used in an automobile jack developed by the Walker Mfg. Co., Racine, Wis., especially for the newer designs of cars with extended splash aprons, sweeping beaver tails, lower chassis, and knee action. The alloy castings, produced by the Wisconsin Cylinder Foundry Co., have the following analysis: Total carbon, 3.20 to 3.30 per cent; manganese, 0.50 to 0.60 per cent; silicon, 1.30 to 1.50 per cent; and nickel, 1.50 to 1.60 per cent. Fifty to 60 per cent of steel is used in the mix.

• • •

Ford V-8 has a new camshaft of cast alloy iron, the metal being similar to that used for push rods (valve tappets).

• • •

The photoelectric pyrometer is used to control the motor which drives a centrifugal pipe casting machine in a pipe foundry near Philadelphia. After the hot metal is poured into the rotating mold, the pyrometer checks the metal and as soon as it is cooled to a predetermined point, causes the motor to shut down.

• • •

CHILL plates which form the bottom face of the molds in which automobile engine valve tappets are cast, are prevented from developing a slight film of rust by the application of a coat of highly refractory aluminum paint.

Five Minutes, Two Dollars

SHORT Range items represent entirely new ideas in the field of castings, in materials, supplies equipment, interesting twists in foundry practice, or suggestions on merchandising. Anything which in the opinion of the editors, is new and useful is entitled to first announcement on this page.

Readers have contributed to make this feature interesting and valuable, through tips and leads. To compensate those who supply material suitable for The Short Range, THE FOUNDRY will pay two dollars for each short item accepted and published. Five minutes time will suffice to write and mail a paragraph suitable for use. The only requirements are, is it a fact and is it new? Two dollars for five minutes is liberal compensation.

Men of Industry

Whose Activities Are Making Foundry History

D. J. CARSON, for a number of years identified with the foundry industry, has been made president and treasurer of the Carson Foundry & Mfg. Co., Tecumseh, Mich., formerly Heesen Bros. & Co. At one time Mr. Carson was manager of the American Malleables Co., Lancaster, N. Y. He purchased the Acme Steel & Malleable Iron Co., Buffalo, in 1915 and served as president and general manager of that organization until 1925 when he sold his interests. Two years later he became vice president and general manager of the H. Brewer & Co., Tecumseh, Mich., and retained that position until last September when than company was sold to the Hillsdale Machine & Mfg. Co., now the Tecumseh Products Co.

HARVEY F. BUSS recently was elected president and manager of the Stark Foundry Co., Canton, O., succeeding the late Elmer E. Miller.

F. G. BENNETT, Buckeye Steel Castings Co., Columbus, O., recently was elected chairman, foundry commitee of the metals section, National Safety council.

FREDERICK P. NEHRBAS, vice president of Servel Inc., Evansville, Ind., has been appointed assistant to the president. W. E. BAKER has been named works manager.

HENRY F. POPE, for the past 21 years president of the National Malleable & Steel Castings Co., Cleveland, and associated with that company since July 1, 1884, recently was named chairman of the board of directors.

CARL C. GIBBS, for the past 5 years assistant to the president, has been appointed president of the National Malleable & Steel Castings Co. Mr. Gibbs became connected with that organization in October, 1905, and served in a minor capacity in the sales department for 4 years. During half of that period he worked one half day in the office and the remainder of the day in the foundry, where he was engaged in molding, carrying iron, etc. In 1910 he was transferred to the sales organization and continued sales work at the Indianapolis plant until March, 1919, when he was transferred to the Cleveland plant in capacity of sales manager. In June, 1920, he was made manager of the Indianapolis plant and continued in that capacity until December, 1929, when he again returned to Cleveland as assistant to the president.

Carl C. Gibbs

E. A. GUMP, for 17 years general purchasing agent of the Wilson Foundry & Machine Co., Pontiac, Mich., has been made assistant general purchasing agent of the Willys-Overland Co., Toledo, O.

FRANK J. STANLEY, has been made general superintendent of the Crucible Steel Casting Co., Cleveland. Formerly he was general superintendent, Locomotive Finished Material Co., Atchison, Kansas. Following graduation from the University of Illinois, Urbana, Ill., Mr. Stanley served his apprenticeship with the Commonwealth Steel Casting Co., Granite City, Ill. He has been prominently identified in the steel foundry field and for 8 years was connected with the Michigan Steel Casting Co., Detroit, Mich., where he attained the position of general manager.

E. W. SECKENDORFF, formerly associated with the Great Lakes Coal & Coke Co., has been appointed to the technical staff of the Battelle Memorial institute, Columbus, O.

C. PARKER HOLT has been named executive vice president of the Caterpillar Tractor Co., Peoria, Ill. Thomas J. Conner has been made vice president in charge of manufacturing, and also a director to succeed the late Pliny E. Holt.

HOWARD COONLEY, president, Walworth Co., Boston, recently was re-elected president of the American Standards association. FREDERICK MOSKOVICS, representing the Society of Automotive Engineers, was re-elected vice president.

R. C. WOODWARD, formerly metallurgist, National Brake & Electric Co., Milwaukee, and for the past year with the Geo. H. Smith Steel Casting Co., Milwaukee, as superintendent, has been made metallurgist for the Bucyrus-Erie Co., Milwaukee.

ALBERT ASHWORTH, for 4 years in charge of the foundry of the Laughlin Marine Hardware Co., Peabody, Mass., recently resigned to become foundry superintendent for the Jenkins Mfg. Co., Bloomfield, N. J. Mr. Ashworth also has served as foundry foreman at the United States Naval Torpedo station, Newport, R. I., and had charge of the foundry of the General

Foundry & Machine Co., Bridgeport, Conn.

* * *

J. J. MURRAY, has been appointed New York district representative for the Swedish Crucible Steel Co., Detroit. Officers are at 225 West Thirty-fourth street, New York.

* * *

JOHN A. VOLAND, formerly secretary and assistant manager, Golden-Anderson Valve Specialty Co., Pittsburgh, has been elected president and general manager succeeding the late C. E. Golden.

* * *

A. E. HARRISON has resigned his position as general superintendent of foundries and patternshops of the Allis Chalmers Mfg. Co., Milwaukee, and has announced his intention to retire.

* * *

ROBERT F. MCCLOSKEY has been appointed vice president in charge of operations for the Blaw-Knox Co., Blawnox, Pa. He previously was general superintendent of the company's shops and has been associated with that organization since 1920.

* * *

CHARLES M. PACK has rejoined the Doehler Die Casting Co. in the position of assistant to the president in charge of all research and development. During the past few years, Mr. Pack has been with Pack-Morin Inc., acting as a consulting engineer and metallurgist in the die casting industry.

* * *

C. E. DAVIES, since 1931 executive secretary of the American Society of Mechanical Engineers, New York, has been appointed national secretary of the society for one year, succeeding the late Dr. Calvin W. Rice. Mr. Davies has been a member of the staff of the society since 1920.

Sands Feature Quad City Meeting

Richard K. Akin, Robert W. Hunt Co., Chicago, was the principal speaker at the regular meeting of the Quad-City Foundrymen's association held at the LeClair hotel, Moline, Ill., Dec. 17. Clyde Burgston, president, presided.

Mr. Akin spoke on "Foundry Sands" and discussed various sand tests, sand control in the shop, and the importance of keeping records on sand. He pointed out that the securing of uniform properties in the sand makes it possible to produce better castings. Mr. Akin also explained many of the difficulties encountered in the production of castings, and stressed the value of a thorough study of defects as a means of establishing proper sand control in the shop. The subject aroused considerable discussion.

The next meeting of the Quad-City group will be held in Rock Island Jan. 21, and will be devoted to the subject of "Malleable Castings."

Acquires Facing Mill Company at Buffalo

Frederic B. Stevens Inc., Detroit, has taken over the plant and equipment of the Columbian Facing Mills Co., Stone street and New York Central railroad, Buffalo. The formula, good will and other assets of the firm also have been acquired.

The Stevens company will move its Erie, Pa., branch to the Buffalo plant to provide better shipping and distributing facilities for the Buffalo district. The facing mill also will be operated for the production for sea-coal facing, core wash, etc.

Judges Award Prize To Chicago Metallurgist

Judges of the contest conducted by the W. W. Sly Mfg. Co., Cleveland, to secure a name for its new blast cleaning equipment, have awarded the prize to L. J. Wise, metallurgist, Chicago Malleable Castings Co., Chicago. Mr. Wise suggested the name "Blastmaster."

The judges in the contest were Charles Seelbach, Forest City Foundries; Homer Tielke, Crucible Steel Castings Co.; and J. L. Battenfeld, Johnson & Jennings Co., all of Cleveland.

Simplified Practice In Cupola Refractories

Simplified practice recommendation R154-34, covering "Cupola Refractories" recently has been issued by the United States department of commerce, bureau of standards. The text represents a simplified practice recommendation covering the sizes of cupola, tap-out and slag hole block, which was drafted at a general conference on May 3, 1932, and subsequently was modified and accepted by the industry and its customers. A list of manufacturers, distributors and users already accepting the recommendation is included in the text. A bulletin may be purchased from the Superintendent of Documents, Washington, for 5 cents.

Officers Elected For Connecticut Group

Connecticut Nonferrous Foundrymen's association elected the following officers at the meeting held Tuesday, Dec. 11 at the Hotel Garde, New Haven: President, David Tamor, Reading, Pratt & Cady Co., Hartford, Conn.; vice president, Joseph T. Judge, Jenkins Bros. Co., Bridgeport; treasurer, Wesley Case, Belknap Mfg. Co., Bridgeport; secretary, Louis G. Tarantino, Bridgeport; executive committee, Herbert Thompson, chairman, Peck Bros. Co., New Haven; G. F. Winslow, Bradley & Hubbard Mfg. Co., Meriden, Conn.; Benjamin Stewart, Bridgeport Deoxidized Bronze Co., Bridgeport; M. F. Hanley, Scoville Mfg. Co., Waterbury; and Ernest Stone, Consolidated Ashcroft Co., Bridgeport. The program committee consists of Frank B. Diana, Whipple & Choate Co., Bridgeport; Joseph Judge and Louis G. Tarantino.

J. A. King, Carborundum Co., presented an interesting talk on "Refractories". Mr. King illustrated his talk with motion pictures.

The next meeting of the association will be held Jan. 15 and will be devoted to a symposium on "Facings, Dressings and Partings". The meeting night of the group has been changed to the third Tuesday of each month.

Discusses Alloys At Philadelphia Meeting

Use of molybdenum in cast iron was discussed by V. A. Crosby, metallurgical engineer, Climax Molybdenum Co., Detroit, before the regular monthly meeting of the Philadelphia Foundrymen's association held Dec. 19 at the Engineer's club, Philadelphia.

A motion picture entitled "Flying Across America in 20 Hours" also was shown following a short talk by M. F. Redfern, United Air Lines.

Specifications on Coal and Coke Published

American Society for Testing Materials recently has published a compilation of all the standard and tentative specifications and tests for coal and coke. This includes five specifications, 13 methods of test and the standard definitions or terms relating to coal and coke. Foundry coke and gas and coking coals are covered by specifications.

Copies of the publication may be secured from the society, 260 South Broad street, Philadelphia, for $1.00 each.

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

IN a symposium on malleable iron castings sponsored jointly by the American Society for Testing Materials and the American Foundrymens association and presented at a joint meeting of these societies in Chicago, June 23, 1931 it is stated that every effort should be made to stimulate co-operation between engineer, designer, manufacturer and foundry. This co-operation will promote the production of castings of the greatest soundness and other desirable physical properties at the least cost. A consideration of the particular defects in casting design that not only cause trouble in the foundry, but make for unreliability of product and a lowering of production will show that the foregoing statement is based on the most solid foundation.

Practically without exception, every foundryman is familiar with instances where designing of castings without consideration of the foundry and metallurgical factors involved has led to high costs and a high percentage of rejections. In the majority of instances changes in design could have been made without affecting the utility of the casting, changes which would have permitted lower production cost and at the same time insured better physical properties in the casting.

Ingots Are Simple Forms

As pointed out in a preceding article in this series dealing with the gating of steel castings, the simplest form of cast metal, the ingot, has been given every attention by ingot makers with a view of promoting soundness and homogeneous structure. Ultimate results have justified all these efforts. Present day ingots constitute a remarkable and gratifying tribute to the scientific and practical knowledge and skill of the ingot makers. All other castings which in fact are modified forms of ingots, present more complicated metallurgical problems in prevention of shrinkage cracks, blows, washes and other forms of defect. This observation applies to malleable castings perhaps to a greater extent than to castings in any other metal. Malleable iron is a kind of a hybrid occupying a place between iron and steel and presenting some of the characteristics of both these metals in process of manipulation.

Designers of malleable iron castings should be familiar with and give proper consideration to several extremely important factors. The stock of the casting should be as nearly uniform as possible and direct connection should be avoided between heavy and light sections. Shrinkage cracks almost invariably will develop at the junction of a heavy and light section. A gradually tapered joint should be provided where it is necessary to increase the thickness of any part of the casting.

A boss or other heavy section cannot be fed properly where it is surrounded by light sections. Unsoundness in an area of this kind may be prevented, in some instances, by placing ribs on the light section sufficiently thick to permit automatic feeding of the part affected. One form of design to be particularly avoided is that of ribs forming a cross. Design of the casting should incorporate sufficient thickness to permit a gate of sufficient size to insure proper feeding of all sections. Fillets should be as large as possible and sharp corners should be avoided.

Dry sand cores constitute a hazard on account of the ease with which the metal cracks in solidifying. This factor must be taken into account in the preparation of a sand mixture that will collapse or yield to a certain extent after the metal has been poured around the core. Experience indicates that a small quantity of rosin in the binder will facilitate yielding of the core. In many instances a green sand core or a green sand core slightly skin dried may be substituted for the dry sand core.

Favor Plain Parting Lines

A straight parting line, or one in which a gradual slope takes the place of abrupt changes in direction will facilitate contraction of the castings and eliminate cracks under certain conditions. Patterns should be designed with ample draft for easy molding. Other embarrassing features crop up occasionally. As a general rule the designer will find it advisable and profitable to consult the foundryman while the design is in the preliminary stage.

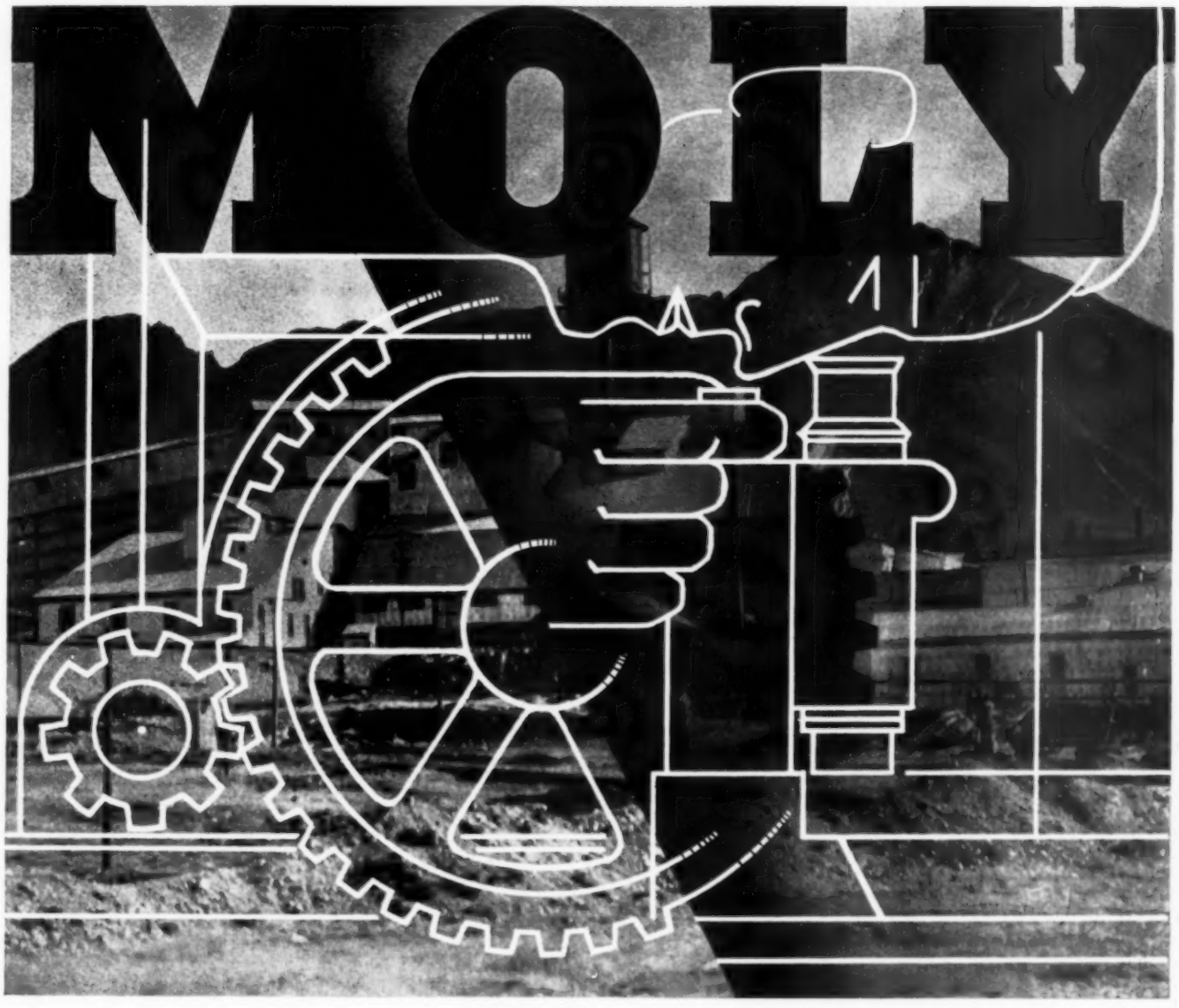
Proper arrangement of gates and risers is an art in which the foundryman can become proficient only after years of diversified experience. The knowledge cannot be acquired through a series of a few easy lessons. Close observation, study and familiarity with the multiplicity of factors involved in the production of castings are required to insure success. This holds true with all metals, but particularly with malleable iron, which in addition to presenting all the hazards incident to the production of castings in any other metal, presents several characteristics peculiarly its own.

The designer usually is quite competent to estimate correctly the sectional areas necessary to withstand safely any stresses to which the casting may be subjected in service. The general problem as it affects both designer and foundryman presents many fea-

(*Continued on page* 40)

Watch the Design

PRODUCTION of high grade malleable iron castings taxes the ingenuity and resourcefulness of the foundryman perhaps to a greater extent than the production of any other class of castings. Due to the peculiar composition, the castings are subjected to more than ordinary shrinkage and contraction strains, first in the as cast condition and later while passing through the annealing stages. Close co-operation is desirable between designer and foundryman to offset hazards incident to ill proportioned sections and other factors which interfere with normal contraction and shrinkage of the metal. Fillets and rounded corners are advocated on all patterns to prevent the formation of incipient cracks. Wherever possible green sand cores should be used instead of hard, dry sand cores.



. . . proved where its journey begins

UNLIKE many products whose merit must be disclosed almost solely by their purchasers' experience with them, "Moly" goes "through its own mill" of service. Here, at the mine which gives it birth, Moly proves itself against such enemies of iron and steel as torturing wear, impact and fatigue . . . in crusher and iron pump parts, in steel shafting and drills.

Further "acid tests" are given Moly at the Climax laboratories in Detroit. Here Moly steels are pulled, bent, twisted and hammered; tested for temper embrittlement, machinability, ease of heat-treatment, tensile strength and fatigue resistance; microscopically examined for defects. . . . All under the eagle eyes of men trained, not only in the science of metallurgy but also in the hard school of commercial applications. Climax engineers do not wait to see what happens *after* the "Moly-ized" product is used at the customer's expense. Like a newly designed automobile on a test run, Moly alloys must fully meet the expectations of their formulators before they are offered for service.

All steel companies and first-rank foundries can supply ferrous products containing Moly — one of the most efficient and economical of alloy elements. Investigate. WRITE for these books: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron* — 1934 *Supplement*." Also keep informed of current Moly developments by asking to be put on the mailing list of our periodical house organ, "*The Moly Matrix*." Feel free, too, to consult our metallurgists and to use our laboratories on any alloy problems. Climax Molybdenum Company, 500 Fifth Avenue, New York. (In Canada: Railway & Power Engineering Corp., Ltd.)

CLIMAX Mo-lyb-den-um

(*Continued from page* 38)

tures outside and beyond the mere calculation of stresses and strains and the choice of a proper safety factor. In the majority of instances the size and position of the gates and risers exert a direct influence on the general problem.

For the purpose of illustration, assume that the customer wants a thin, flat disk 4 or 5 feet in diameter and assume further that this casting will not be subjected to any particular strain or stress in service. The designer readily may estimate the thickness of metal required for the casting to stand up safely in service, but that thickness may be outside the range of practical accomplishment in the foundry, or, it can be produced only with the greatest difficulty and added expense. Unless other factors make the extremely thin section mandatory, the design should be changed to a thicker section to facilitate the work in the foundry. Since thin wood patterns of large area invariably warp in service, extra thickness may have to be added to overcome this tendency. Where the volume of orders or other factors warrant the expense, plaster or metal may be substituted for the wood.

Gate May Be Too Small

A thin section in the casting between the gate and a heavier section will prevent the gate from fulfilling its secondary function, that of feeding the heavy part. For example, a casting with a hub in the center may be very intricate and of such a character that commercially and practically it must be gated on a flange that may be too thin to permit the use of a gate thick enough to allow for proper feeding, even where feeding heads are provided at available locations. A slight increase in thickness of flange would permit the use of proper size gates and the production of a sound casting. Provided the extra thickness would not interfere with the assembling or ultimate use of the casting, a local thickening of the flange for the width of the gate should be permitted. However, this may be regarded more as an emergency measure or a compromise than a permanent solution of the problem.

Soundness and homogeneity are of much more importance in malleable iron castings, than in castings of other metals, principally because a hard spot will be found wherever there is a shrink. As a result, machining difficulties will be encountered. The designer should be in a position to anticipate casting difficulties and should afford the foundryman every possible opportunity to secure sound castings. Manifestly something must be wrong with the design when despite every expedient in the foundry, sound castings cannot be produced on a practical commercial basis.

Wherever possible the outer circumference of thin flanges and other castings of a generally similar character should be rounded instead of square cornered. Malleable iron castings in the initial or as cast stage, are brittle white iron in a state of strain. A sharp corner readily may develop a minute check or crack that will extend to larger size and extent, particularly in the vicinity of the gates where the metal usually cools last. Losses due to cracks of this character in many instances have been eliminated entirely, or in other instances greatly reduced by slightly rounding the former square corners of the patterns.

Designers who are not familiar with the peculiarities of malleable iron fail to take cognizance of the fact that a thin section will cool in the mold much faster than a section which is thicker or heavier. This means that the metal in the two sections is passing through its critical temperature range at different intervals of time. One section is contracting while the other is expanding. Strains set up through this phenomenon will cause the castings to crack with a resulting increase in the percentage of rejected castings. Disproportionate sections cannot be avoided entirely, but in many instances the thickness may be equalized to a certain extent by reducing the thickness on the heavier parts and increasing it on the parts which are unduly thin. Attention of the designer should be directed to the fact that in many instances a casting is made up of various parts, each separate part joined to its neighbor by a connecting section of metal. The thin section, cooling more quickly than the other will draw metal from an adjacent heavy section. As a result a porous area if not an actual shrinkage cavity may develop in an extremely undesirable location. Fillets in the corners not only remove a source of weakness, but also facilitate the cleaning of the castings.

Customers occasionally become impatient over the time required by the foundryman to submit a sample casting from a given pattern. In some instances the complaint may be justified, but usually a little friendly investigation will show that the foundryman is entitled to a crown rather than to a cross. He practically has exhausted his ingenuity in an effort to produce a casting from a practically impossible pattern. Co-operative effort invariably will secure better castings, a saving in time for customer and foundry and avoidance of unfortunate misunderstandings.

Although the general practice in the manufacture of malleable iron castings has been standardized to a considerable extent and the product shows a marked improvement over that formerly turned out in malleable iron foundries, leading authorities have not yet arrived at complete unanimity of opinion. Several features still are in the controversial stage. For example in an article published in the Dec. 15, 1922, issue of THE FOUNDRY, M. M. Marcus states that where abrupt changes in section cannot be avoided, shrinkage may be overcome by the use of chills on the heavy sections. These chills tend to accelerate cooling. In an alternative method risers may be placed on the light sections as close as possible to the point at which the different sections join. The risers or shrinkage heads should be heavy enough to feed the light sections.

Commenting on this in the Jan. 15, 1923, issue, Joseph B. Deischer inquires is it not a fact that lighter sections by virtue of being light, solidify first and after freezing cannot be fed? All cooling is from the surface to the center of the casting. The shrinkage caused by contraction of the mass after solidification is located as a result of the metal that solidified last rather than by that which solidified first. In other words, it is the slow cooling of the heavy section rather than the rapid cooling of the lighter section that causes the shrink. Were the heavier section adjoining the lighter section fed by a riser of the proper size and through a gate or neck thicker than the heaviest section of the casting, the shrink would be driven from the casting into the riser where the molten metal was the last to solidify. However, the riser should feed the heavy section and not the light section. Use of a riser is the proper method, where its location is possible, as too often the use of chills only drives the shrink to some other part of the casting.

Silicon Affects Carbon

Later in the same article Mr. Marcus states that the silicon exerts no influence upon the carbon during melting. If during a heat a test bar were poured at an early stage the fracture would be gray, because the silicon is high enough to prevent the carbon from remaining permanently combined with the iron after solidification. However, by holding the metal in the furnace, the oxidizing action of the furnace gases gradually lessens the silicon in the bath and a point finally is reached where the carbon will remain in the combined state and a sample then will be uniformly white.

Mr. Deischer admits that what is said about the carbon combining is true, but the explanation of the cause may be somewhat misleading. Chemical analysis of a test taken as soon as the iron is molten enough to pour

(*Concluded on page* 43)

ADVERTISING PAGES REMOVED

(*Concluded from page* 40)

will show that practically all the silicon loss has been accomplished, in spite of the fact that such a test shows a gray fracture. After the iron is melted to a bath, the combining of the carbon will depend first upon the increase in temperature and second, the reduction in total carbon which is accomplished by the increased temperature and not upon further silicon loss as suggested. In other words, practically all the silicon loss occurs before skimming, and all the carbon loss after skimming, providing furnace operation is normal.

Although the author of the article referred to is backed by some of the leading authorities on the sulphur-manganese formula "Manganese twice the sulphur, plus 15" Mr. Deischer claims that in his practice he has found that twice, plus 10, gives better results.

The foregoing refers to malleable iron melted in the reverberatory or air furnace when the entire charge is melted as a unit on the hearth. Conditions vary to a certain extent.

Iron must be melted extremely hot to pour the thin sections and the chemical composition of the metal must be such that all the carbon will be in the combined form as cast, and in such combination that the white iron castings can be annealed to produce a good black heart malleable. Extended discussion on this phase of the subject lies outside the scope of the present series.

Hot iron for malleable castings means clear hot in the ladle with no sign of cooler iron floating on top. The melting of this iron is more dependent on one item of control than on all other possible variables. This item is the height of the bed above the tuyeres and constant maintenance at this proper height. The bed is high as compared with gray iron melting practice. Depending on blast pressure and volume it has been found in practice that a height of 41 to 51 inches of coke above the tuyeres will melt good hot iron.

This is the fifty-ninth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The sixtieth instalment will appear in an early issue—THE EDITORS.

Committee Arranges Apprentice Programs

Since its organization in August, 1934, the Federal Committee on Apprentice Training has arranged for full operation of an approved apprentice program in Wisconsin, complete organization in Michigan and Delaware in which approved plans are soon to be offered to industry, and assisted in the appointment of state committees in 23 states

Committees have been appointed and approved by the secretary of labor and procedure is now being formulated in California, Oregon, Wyoming, Colorado, North Dakota, Minnesota, Iowa, Maine, Arkansas, Mississippi, Alabama, Tennessee, Kentucky, Ohio, West Virginia, Texas, Maryland, Virginia, North Carolina, South Carolina, Rhode Island, Massachusetts, and New Hampshire.

State committees are charged with approving apprentice contracts submitted to them, issuing certificates of code exemption to employers, registering apprentices, supervising their training, organizing, administering, and co-operating with educational authorities in the school program for apprentices, revoking apprentice contracts in cases where they are abused and issuing certificates or diplomas upon completion of apprenticeship.

The program put into effect after state committees are approved is entirely elective with employers. Unless specific requests are received for approval of individual apprenticeship contracts, code rules will apply.

For the purposes of the program, apprentices are persons of at least 16 years of age who have entered into written contracts with employers or associations of employers providing for at least 2000 hours of reasonably continuous employment and also providing for participation in an approved program of training.

Many codes provide that during a learning period of from 1 to 3 months an inexperienced employe may be paid less than the code minimum wage. Apprentice training under this program relates, however, to those occupations in which at least 2000 hours are required to train an all-around mechanic or a skilled worker. Proper training includes gaining experience in many departments of a plant and receiving systematic instruction from foremen, skilled workmen, and special instructors.

An apprentice contract carries with it a responsibility for a period of training in a skilled occupation. As the training period progresses, the value of the apprentice to the employer increases, and at the end of the period he will be worth more than the minimum wage. It is provided that the apprentice's wage start at not less than one-fourth of the current journeyman's wage, that it be advanced at regular intervals during the training period, and that for the apprenticeship as a whole it average not less than 50 per cent of the journeyman's wage.

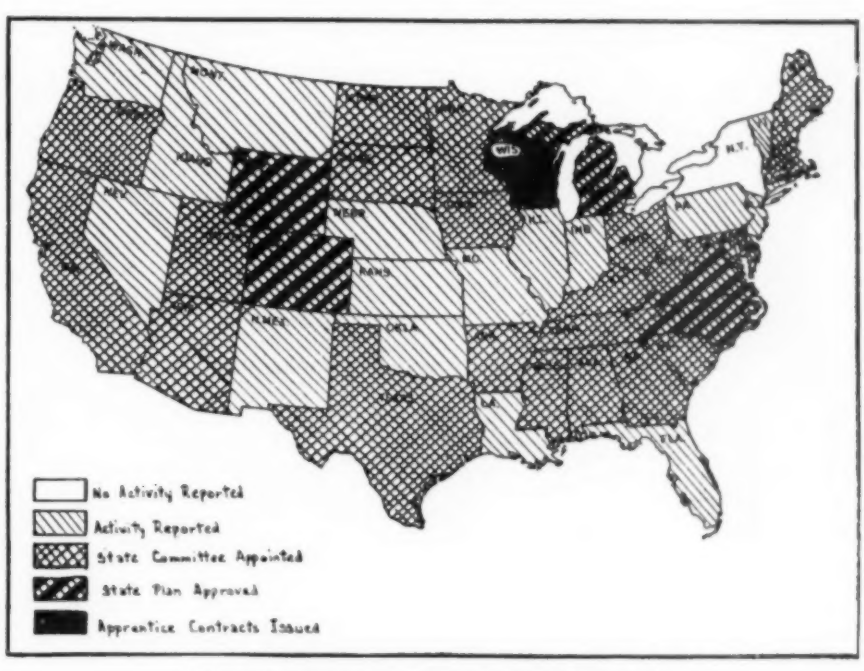
Certificates of exemption permitting the employment of apprentices at these wages will be granted by an agent of the State committee on apprentice training only if the employer enters into a written contract with the apprentice and agrees to the following:

1. The apprentice shall receive training for a stated number of years, not less than 1 nor more than 5.

2. The apprentice shall receive instruction in general and technical subjects for at least 144 hours per year.

3. The apprentice's hours of work and instruction, combined, shall not exceed 44 hours per week or the maximum hours fixed by the code for the industry.

4. The processes which apprentices are to learn and the actual wage scale must be stipulated in the apprentice's contract and approved by the State committee. Advisory committees, composed of employers and employes in the different trades and occupations, may be consulted by the State committee before these rules and regulations are put into effect.



Status of apprentice program in various states

Care of Cupola Refractories

Type of product manufactured influences life of the furnace lining considerably

By C. E. BALES
Ironton Fire Brick Co., Ironton, O.

METALLURGISTS and refractories engineers now generally agree that the following factors of destruction determine the life of cupola linings: Intense heat in the melting zone; chemical erosion by the flux and slag; cutting action of the blast; abrasion by coming-down charges; spalling; breakage loss caused by chipping out the cupola.

The purpose of studying further the results of these factors the cupola may be divided into four parts: (a) The zone above the charging door, (b) the zone between the charging door and top of the melting zone, (c) the melting zone proper, and (d) the crucible. Conditions above the charging door are not at all severe and need not be considered here.

That part of the lining between the charging door and top of the melting zone is subjected to severe abrasion, especially if the charging is done carelessly, and this abrasion is an important cause of failure. Near the top of the melting zone the blocks are not only affected by abrasion, but they are subjected to a high temperature, and particles of slag and molten iron are blown against the lining, which may cause small flakes of the brick to spall off.

Stand Severe Abuse

In the melting zone, the blocks are subjected to a high temperature, chemical erosion from iron oxide, coke ash, flux and the slag, and to thermal shock. The latter is severe when the bottom is dropped and water is turned on the lining.

In the crucible, the lining is subjected to high temperatures, molten iron (which may cause trouble if it is badly oxidized), and thermal shock.

Cupola operation has a great deal to do with the life of the fire brick lining, and unless it is done properly, no fire brick will last long. Life of the lining in the melting zone varies over wide limits, and as determined by a recent questionnaire, may be from 9 to 525 hours. Of course, the *burning away* of the lining above the tuyeres is normally proportional to the melting zone temperature and the duration of the heat. Extreme cutting in one spot, which usually occurs over a small bridge or between tuyeres, results from excessive oxidation at that point.

Nature of the mixture used in the cupola has considerable bearing on the life of the lining. A high percentage of steel scrap with its higher melting temperature decreases the life of brick in the melting zone. Steel scrap should be in small pieces.

The fluxing material is also important, and limestone and fluorspar, if used, should be kept at least 6 inches away from the lining. Fused sodium carbonate, although it does have a glazing effect on the brick, is so effective in forming a fluid slag and in clearing out corrosive slag, that its use in the cupola cannot be considered as detrimental to the lining. Important factors in determining the life of the lining are the size of the heats melted, the length of time the cupola is operated each day, and the temperature of the metal when tapped.

One of the greatest causes of trouble with the brick lining in the melting zone is an excessive blast. A high-pressure blast will oxidize some of the iron, and the resulting iron oxide is exceedingly corrosive to the lining. For this reason, a volume meter is far more reliable than a pressure gage.

The cupola lining can be kept intact much longer than usual, provided the last charge is not coked, and the blast is shut off as soon as a white heat is reached. More fire brick are *burned* in the cupola at this time than at any other period because the blast works directly on the lining. The blast is not needed after the stock turns white, as the bed will melt any small amount of iron that may be left.

The type of product manufactured has a great deal to do with the life of the lining. Malleable castings made directly in the cupola are hard on the lining and a more refractory block is required than is the case where only gray iron castings are made. This is due to the higher operating temperatures, and because considerable steel scrap is used in malleable mixtures, as well as a larger quantity of coke. The slags from malleable cupolas are usually *foamy* and of a dark blue color, showing that they contain considerable iron oxide. Such slags are corrosive to the lining, whereas slags of a grayish green color and of a hard glassy nature are comparatively easy on the lining.

Lining Burned Away

In large, continuous-pour foundries, the 6-inch lining in the melting zone may be completely burned out each day, and it is probably more economical to replace the lining with blocks instead of patching and daubing. Where only part of the lining is burned away, it is decidedly good practice to patch with 9-inch brick and No. 1 splits or a good daubing mud.

There are probably as many daubing mixtures as there are gray iron foundries. Some of them prolong the life of the lining, while others actually help to destroy the lining. The following mixtures are giving good service in foundries, and they help to preserve the lining:

No. 1

1 part plastic fire clay (fusion point at least cone 26)

(*Concluded on page* 48)

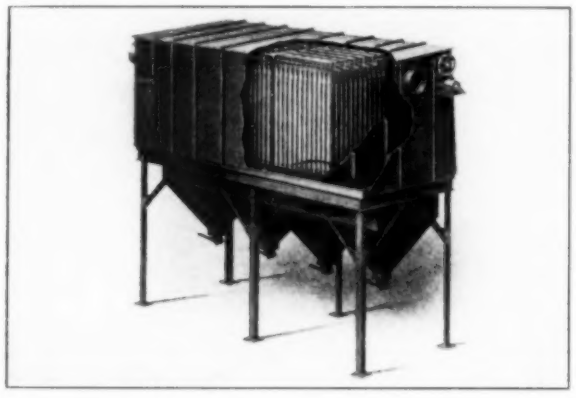
Longer Service

SERVICE rendered by cupola refractories depends upon the consideration given certain important factors by those in charge of operating that type of melting medium. Proper selection of high grade cupola blocks and attention to operating details should mean longer service, more efficient cupola operation and lower maintenance costs. This article on cupola service conditions is abstracted from a technical bulletin of the American Refractories institute, Pittsburgh, entitled "Refractories for use in Cupolas." The author is vice president, Ironton Fire Brick Co., Ironton, O.

BE READY TO COMPETE . . .

REPLACE OBSOLESCENT EQUIPMENT NOW

WATCH obsolescence! It is the big factor in all lines of manufacturing. Out-of-date, rundown equipment can't produce castings in competition with modern foundry equipment and methods. Low cost of operation is the goal today. With fifty years of foundry equipment pioneering—Whiting offers you such cost-reducing equipment as the roller-bearing tumbler, tube-type dust filter, new ladle gearing, quick-anneal oven, pulverized coal-fired rotary furnace, etc., to enable you to increase profits.



NEW TUBE TYPE DUST FILTER

Gives Effective Dust Removal With Low Cost of Maintenance

Chief advantage of this new tube type filter is low cost of operation and maintenance.

Individual tubes are easily and quickly inspected or replaced, and always from the *clean air side.*

Steel footwalks inside the housing, on both sides and end, make every bag easily accessible for safe inspection and repair.

These features protect maintenance men against hazards of dust.

Other advantages are:

Long life of cloth tubes.
Better cleaning action.
Substantial weatherproof housing.
Rugged shaking device with motor on outside of housing.
Standard units for any capacity.
Extreme simplicity and safety.
Full details in Bulletin 194.
Send for a copy.

NEW ROLLER BEARING TUMBLING MILL

Cuts Power Cost 50%

Operating records on this new type mill show a 50% saving in power cost over the older design, due to Hyatt roller bearings and counterbalanced barrel construction.

Other superior features, first introduced by Whiting, include:

Positive door clamps seal and reinforce door—easily and quickly removed.

Combination clutch and brake automatically holds mill for safe loading or unloading—saves time.

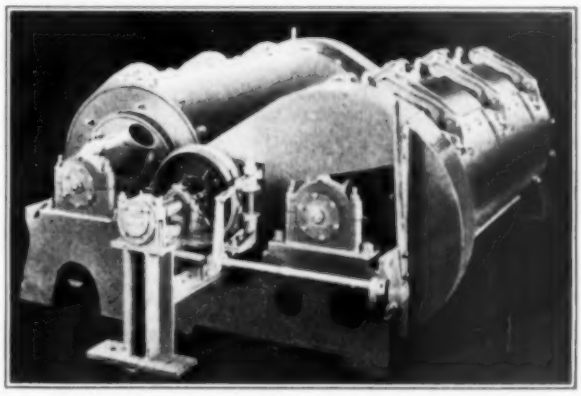
Speed reducer drives and helical gearing give smooth operation and long gear life.

Door openings full length of mill for easy loading.

Streamlined air passages cut air friction losses.

A balanced, rugged mill with an outstanding record for durability and low-cost operation.

It's worth looking into.



WHITING CORPORATION

15607 Lathrop Avenue — Harvey (Chicago Suburb) Illinois

OVERHEAD CRANES FOUNDRY EQUIPMENT

WHITING

50 YEARS OF SERVICE

SPECIAL MACHINERY COMBUSTION EQUIPMENT

Producing Malleable Castings

(*Concluded from page* 18)

to dust. The dust is drawn by suction and delivered into a storage tank. Any large particles drop by gravity en route and once more enter the pulverizer.

Individual pipes carry the pulverized coal from the tank to the melting furnace and the annealing ovens. Secondary air for complete combustion is supplied by fans in the vicinity of these units. Through hand operated valves the supply of air or coal may be adjusted through a comparatively wide range to meet fluctuating conditions. While one main pipe carries a full supply of coal for all the ovens, an individual valve between the main pipe and the burner regulates the amount delivered to each burner, or shuts it off altogether. The excess coal is carried back to the supply base for further circulation. The flame enters the oven at one end near the roof and is deflected downward through the tiers of pots to the floor. Two small openings in the back wall near the floor lead to the flue which extends under the outside floor to the stack.

Temperature Is Controlled

A pyrometer attached to each oven indicates the temperature at each stage of the seven-day annealing period. It is claimed that these temperatures are attained and maintained more readily with the mechanical equipment than under the hand firing method formerly employed. In addition to reducing the labor cost, the present method practically eliminates the hazard incident to any operation depending on the human element. The same holds true with the melting furnace which also formerly was hand fired.

A fluctuating volume of castings is made for outside interests, but most of the castings are various types of connections for high pressure pipe line service, a field in which the Lockport Fittings Co. has specialized for many years, serving both the domestic and foreign markets. These castings are finished in the company's machine shop and tested for strength and homogeneity. Therefore the iron must conform to unusually high standards. Borings and turnings from the machine shop are sold to blast furnace operators in preference to utilizing the material as part of the furnace charge.

Cylindrical test bars 1½ inches in diameter are poured at half hour intervals after the metal has melted and before it is tapped. Fracture of these test bars indicates the progress of the carbon into the combined state. A further check is taken periodically by pouring metal into a cubical block 3½ inches in thickness. If any free carbon is present in the iron it will show up in the center of this thick section. If necessary, minor adjustments are made to the composition of the iron in the furnace by the addition of small quantities of ferrosilicon, silicospiegel, ferromanganese and petroleum coke. With the composition adjusted properly, the fluidity is tested by pouring a small quantity of iron in a thin spiral ring provided with small knobs at graded intervals. When the iron fills this ring for a definite distance it is considered sufficiently fluid to pour any casting in the shop.

Bull ladles mounted on wheels are employed to carry iron to the distant floors where it is transferred to hand ladles in the hands of the molders. Men working on floors near the furnace *catch under* the stream from the furnace spout with hand ladles. The tap hole is stopped temporarily if no ladles are available, but for the greater part of the pouring period the iron flows in a constant stream from the spout.

Molding floors extend from the gangway on either side to a 4-foot high partition in the center. A battery of combined jolt and squeeze molding machines made by the Osborn Mfg. Co., Cleveland, extends from end to end on either side of the partition. Sand is piled up in the vicinity of each machine and the completed molds are laid down in the usual manner, commencing close to the gangway and gradually working backward to the vicinity of the machines. Under normal conditions two heats are poured daily and a surplus amount of sand is provided so that the molders may continue operations with cold sand while the sand from the molds in the previous heat is cut over, cooled and reconditioned for use. The molders pour their own castings, but a separate gang shakes them out and reconditions the sand.

Gates and castings are separated on the gangway. The gates are taken to the furnace and the castings are loaded in small tote boxes, placed on a roller conveyor and pushed forward to a vertical elevator which discharges them on a second roller conveyor about 15 feet above the floor level. The contents of the boxes are dumped into large bins with sloping bottoms. The empty boxes continue on their way to the ground floor. At regular intervals a gate at the bottom of each bin is opened and the castings slide by gravity over a chute leading to any one of a number of tumbling barrels. Later the tumbling barrels are opened and the castings fall into other tote boxes also mounted on a roller conveyor which takes them past a battery of grinding stands. On an adjoining conveyor the empty boxes are carried back to the starting point. Certain castings on which the heat developed by grinding might have an adverse effect while in the hard iron state are not ground until after they have been annealed. A continuous form of inspection is maintained over the castings by close observation at each of the transfer points.

To prevent distortion, the cleaned castings are packed in spent molding sand in the annealing pots. The pots are lifted one at a time and placed on the conveyor to meet the incoming castings. The conveyor carries them in front of a chute in the side of a sand bin. Sand and castings are packed in until the pot is filled. Then a lid is adjusted in place and the joint luted with clay to prevent oxidation of the castings. The loaded pots are stacked three high on the floor and then picked up on the nose of a charging machine which places them in the oven where they remain for seven days undergoing a heat treatment which converts the hard and brittle castings into objects with a tensile strength of 55,000 pounds per square inch and an elongation of 18 per cent in 2 inches.

Castings Cooled Slowly

A period of 48 hours is required to raise the temperature of the oven to 1600 degrees Fahr. where the austenite absorbs carbon from the pearlite and precipitates it as temper carbon. This temperature is maintained from 48 to 60 hours. To prevent reversion to the relatively hard pearlite in passing through the critical temperature and to effect a complete precipitation of the carbon, a very slow rate of cooling, not more than 8 to 10 degrees per hour is maintained down to about 1275 degrees Fahr. This breaks up the austenite into ferrite and temper carbon, the final constituents of malleable iron.

The loaded pots are removed from the oven and the contents are dumped over a grating. The sand falls through the grating into a box which later is removed with a small hoist and the sand dumped into the container to be used again in filling other pots. The castings are loaded in small steel boxes mounted on one of two branch conveyors. Those that require no further attention are routed for the store room adjoining the machine shop. Castings which escaped the grinders in the first stage, or castings slightly oxidized in the annealing process are ground and sandblasted and then transferred to the conveyor leading to the machine shop.

Castings to be galvanized are taken into an adjoining building where

(*Concluded on page* 48)

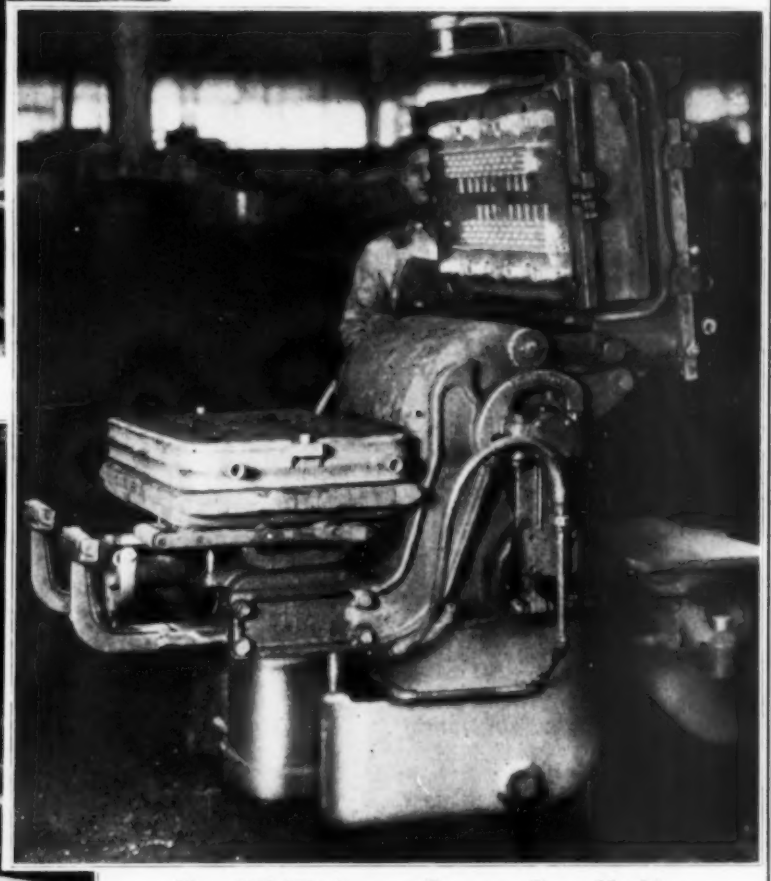
Type SB 11 Core Blower

INTERNATIONALS

63 Standard Types for Castings.

14 Standard Types for Cores—including 3 designs of *Blowers*.

Many Special Types for work of unusual character.



Type F II Jolt Squeeze Turnover Draw Machine

Type JDP Jolt Ram Power Lift Machine

INTERNATIONAL MACHINES insure
Lowest Cost Highest Production
Minimum Maintenance Expense
Prompt deliveries on all standard types of machines required for RUSH WORK.

INTERNATIONAL
MOLDING MACHINE CO.
2608-2624 W. 16th St. Chicago, Ill.

(*Concluded from page* 46)

they are first dipped in an acid bath, then dried on a large plate over a coke fire, and then immersed in a steel tank 2½ x 3 x 12 feet containing about 20 tons of molten zinc at a temperature of 850 degrees Fahr. The tank is heated by a deep, narrow coke fire at either side and the temperature is indicated by pyrometer and regulated by a number of dampers at the lower part of the side walls. Part of the galvanizing building is set apart for a core department where the cores are dried in a drawer type oven made by the Foundry Equipment Co., Cleveland.

Pass Severe Test

Since practically all the castings must be leak proof, in many instances under high pressure, it is essential that the metal in all sections shall be free from all forms of shrinkage defect, cracks, draws, cavities, porosity, sponginess or segregation. Particular attention is given to adaptations of gating systems to bring about this desirable result. The patterns are mounted on matchplates with gates and risers in place. This arrangement not only facilitates the molding operation and insures perfectly clean passages for the metal, but eliminates one of the variable factors, when the size, shape and position of gates and risers are left to the discretion of the molder. Typical examples of the application of gates and risers are shown in accompanying illustrations.

The system is based on the theory that the hottest metal is required in the riser which feeds the casting, that a large amount of metal is needed in the riser and that this riser should be in position to heat the sand in the vicinity. This object has been accomplished by introducing the metal into the bottom of the riser and then allowing the metal to flow from the riser through a large feeding gate into the casting.

It will be noted that this is in direct opposition to the usual method where the metal from the gate enters the mold cavity, then flows into the feeder and thence into the riser. As a result the metal in the riser, particularly at the top is lower in temperature than in any other part of the casting and therefore is not so effective in the anticipated function of feeding the casting.

In this connection it is interesting to note that this method frequently was advocated by the late Charles Vickers for certain classes of nonferrous castings. The basic features, that is flowing the metal through the riser into the casting and thus securing maximum temperature in the sand around the feeder, were referred to by George Batty in a paper dealing with gates and risers on steel castings presented at the recent convention of the American Foundrymen's association in Philadelphia.

In some instances as in Fig. 4 the sprue is placed directly above the large end of the horn gate which conducts the metal into the bottom of the riser. In Fig 5, showing a larger casting fed from two risers a strainer core is inserted at the point where the sprue joins the horn gate. In addition to functioning as a strainer the core also retards to some extent the velocity of the descending stream.

An alternative method for breaking the fall of the metal and thus retarding the velocity of the stream entering the mold is shown in Fig. 6 where a short horizontal gate at the joint of the mold conducts the metal from the sprue to the entrance to the horn gate. This same idea to a greater extent is illustrated in Fig. 7 where the sprue extends a short distance into the drag to form a well or cushion for the falling metal. A horizontal passage cut in the cope conducts the metal to the horn gate.

A combination of both methods is shown in Figs. 9 and 10 and a pair of typical pattern plates is shown in Figs. 11 and 12.

Care of Cupola Refractories

(*Concluded from page* 44)

2 parts white silica sand (Waste sand from the sandblast machines is excellent for this purpose provided it does not contain too much iron scale.)

No. 2

4 parts plastic fire clay (fusion point at least cone 26)

6 parts crushed fire brick—all through 10-mesh screen (Old fire brick from the cupola lining can be crushed by placing in a tumbling barrel containing a few pigs of iron.)

Either of the above mixtures should be thoroughly mixed with enough water to make a stiff, plastic mud. The mixing can be done in a small muller machine such as is used in mixing molding sand.

Addresses Group on Producing Refractories

John Owen, Harbison Walker Refractories Co., Chicago, addressed the regular meeting of the Northern Illinois Foundrymen's association held on Dec. 11 at the Elk's club, Rockford, Ill. Mr. Owen discussed the manufacture and research work of the refractory industry and illustrated his talk with motion pictures.

P. S. Toney, chief engineer, International Lead Refining Co., East Chicago, Ind., presented a film, "A Cheechako on the Mountain Trail". Mr. Toney explained that a "cheechako" in western parlance, was a tenderfoot. The scene of the film was in the Banff National Forest.

English Use Road Blocks of Cast Iron

Cast iron road blocks, made by Platt Brothers & Co. Ltd., Hartford Works, Oldham, England, are 11¾ inches square and are hollow on the under side, according to *Engineering*. Projections are of two sizes, the larger being 1-inch square and the smaller ⅝-inch square. All are ¼-inch in depth and the pitch is 1½ inches, these dimensions being sufficiently close to provide a level surface for pedestrians and narrow-wheeled vehicles.

The under side is designed with reinforcing spurs, which increase the strength and enable exceptionally heavy loads to be imposed safely. Crushing load tests conducted at Manchester College of Technology show that a block will stand a pressure of 100 tons without breakage. The weight of each block is 20 pounds. The blocks are laid on concrete foundation in a bituminous composition about ⅛-inch thick and the joints are filled by ¼-inch of that material.

Alternate large and small projections with which the surface of the road block is provided is claimed to eliminate risk of skidding. Other advantages claimed are that the surface drains rapidly, is cleaned easily and that the blocks can be laid quickly in case the road must be torn up for access to pipe, cables, etc. Also, it is claimed that the surface can be repaired readily.

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

TO THE EDITOR:

I wish to correct you on an article regarding M. L. Bettcher, Duriron Co. Inc., Dayton, O., which appeared in your December issue under the heading "Men of Industry." Your statement that Mr. Bettcher was an officer in the 309 Engineers is incorrect. He was a 1st Lieutenant, and a good one, if I may say so, of Company E, 308th Engineers, 83rd division. It was my honor to be a member of his platoon.

JAMES KELLAR,
Assistant Superintendent.
Ohio Foundry & Mfg. Co.,
Steubenville, O.

ADVERTISING PAGES REMOVED

Points to Causes of Porosity

(*Continued from page* 19)

customer substantially balance each other. Porosity today is as serious a problem as it was 20 years ago, considered in respect to the current standard of acceptability adopted by the average buyer. Emphasis placed on certain manufacturing principles that are more or less generally known may be helpful to foremen who are expected to make steel castings free from pin holes.

Everyone familiar with the circumstances knows that pin holes in steel castings are caused by gas which may come from each of several sources. Steel made as nearly perfect as is now commercially possible contains some gaseous and other impurities when it is discharged from the furnace. Experience demonstrates that well made steel as tapped does not contain enough gas to cause complaint regarding porosity, when all conditions of metal transfer from furnace to mold and when all conditions within the mold itself are as nearly perfect as they can be commercially maintained while making certain kinds of castings. Gas of an amount and kind that may cause porosity in a satisfactory mold may exist in steel as it emerges from the furnace spout, if the metal is not properly conditioned before tapping. That gas always is generally in every kind of sand mold, whether or not poured under ideal conditions of metal and mold, is patent to everyone who occasionally witnesses foundry operations.

Steel May Absorb Gas

Commercial steel satisfactorily (while not entirely) degasified before it is discharged from the furnace may absorb some gas that subsequently will be manifested by porosity, in one or more ways by which the metal may be contaminated in its transfer from furnace to mold, or in its function of filling the mold. Foundrymen argue as to whether most of the porosity in steel castings is caused by defective metal or by improper mold conditions. It is doubtful whether such general discussions are helpful, since they make furnacemen and molding foreman blame each other dogmatically, during occasional porosity epidemics to which some steel foundries unfortunately are subject. All the operations required for the manufacture of a steel casting are essentially such as to introduce a greater number of potential hazards in respect to molds than in respect to metal. More details of the personal element are involved in making most molds than in melting steel, with a correspondingly greater opportunity for shop practices to go wrong with the receptacle that will receive the metal to form a casting.

Mere contact of the liquid steel with the atmosphere and with any material that may form gas may develop a condition in the metal ultimately manifested by porosity. Liquid metal generally seems to be highly susceptible to contamination through contact with gas and many other substances. Because the shop atmosphere presents the opportunity of an oxygen pick-up by the steel, metal that has minimum contact with the atmosphere from the time it is tapped until it is poured into a mold obviously has the least opportunity to become contaminated in its necessary transfer. This means that a bottom-pour ladle offers the least opportunity during transfer, for deterioration by oxygen, one fruitful source of porosity. Logically then, the emptying of the furnace into a large bull-ladle, followed by transfer of the bull-ladle metal to the molds by shank pots carried a considerable distance mechanically or manually, provides the maximum opportunity for the metal to absorb oxygen and thus acquire a greater tendency to throw the final balance on the wrong side, and cause porosity in the steel casting. This balance will be referred to later.

Liquid steel always is receptive to the influence of every element which may be present as a constituent of the shop atmosphere, and of the linings for furnace spouts and for pouring ladles, even prior to entry of the metal into the pouring cup of the mold. At no time following the tapping of the heat does there exist an entire absence of conditions which may cause porosity, and which frequently result in that defect if careful precautions are not taken by the men on the foundry floor. Obviously, this important fact should be kept in mind constantly by every member of the staff responsible for pouring, molding or core-making details.

Before discussing specifically those conditions obtaining within the molds which may cause porosity, a few comments on what many persons call final deoxidation seem to be in order.

Seek Aluminum Substitute

Much work has been done intelligently but unsuccesstully to find a substitute for aluminum which would have that element s marked affinity for gas, but would not injuriously influence the ductility of steel in the manner frequently demonstrated when aluminum is introduced and tension test bars subsequently are pulled. It is pertinent to remark that since *gas* and not merely oxygen which we want to eliminate, and since there are several gases present in the steel, the term degasification rather than deoxidation is the more appropriate to use in connection with the final efforts to condition the steel for the prevention of porosity and blow holes in castings.

Some foundrymen pin their faith to special degasifying practices in the belief that these represent a technique superior to that involving the customary addition of aluminum. Others have held that essentially the incidental rather than the primarily sought effects of gas elimination by means of aluminum are different from the results obtained when another active degasifier is used. Some experiments made during the past few years have thrown considerable light on this entire question. Evidence presented by Sims and Lilliequist—*Transactions*, Iron and Steel division, A.I.M.E., 1932, page 154—rather strongly indicates that we need not necessarily be handicapped by significant loss in ductility through the use of aluminum, but that we may introduce compounds that serve to make the impure products caused by aluminum addition to be much less injurious than they usually are, as ascertained by certain physical tests. Careful work done suggestively points the way to feasible practices that may be depended on ordinarily for making inclusions behave themselves decently, when they are caused by adding aluminum to steel.

When any element or compound eliminates any gas from steel, the constituents of the gas are not actually destroyed. They merely have became transformed into what will

Shop Practice

IN A CONTRIBUTION to a brief symposium on the causes of and measures to be adopted in the prevention of porosity and pin holes in steel castings the author confines himself mainly to practical rather than to the purely scientific phases of the problem. Following a detailed description of the various forms which porosity may assume he directs attention to the fact that the importance attached to this form of defect varies in different classes of castings. While pin holes and other forms of porosity are not as prevalent as they were in the early days, the attitude of customers has changed and they demand more perfect castings. The article is from a paper presented at the convention of the American Foundrymen's association in Philadelphia, Oct. 22-26, 1934. The author is a foundry consultant, Chicago.

become solids, in some kind of association with other elements. These resulting nongaseous impurities become disseminated through the metal in the form of inclusions that usually are so small as to be observable only under the microscope. It seems unreasonable to imagine that any degasifying element would not put into the steel substantially as large an amount of impurities in the form of inclusions as is created when we introduce aluminum—provided the material substituted for aluminum would be equally effective in eliminating the gas.

Obviously it becomes highly desirable to develop a practice that may make harmless the inclusions created by degasification. The work done by Sims and Lilliequist indicates that iron oxide is useful for the purpose referred to, by causing the inclusions developed by the introduction of aluminum to assume rounded rather than elongated shapes. Considerable evidence has been presented tending to show angular and elongated rather than the spherical inclusions found in aluminum-treated steel are harmful to ductility, as indicated by the tension test. Seemingly, long inclusions have a tendency to form continuities, in chains somewhat roughly resembling irregular streaks of foreign matter. When the inclusions are more nearly spherical, they appear to maintain a sort of individual independence, having no significant inclination to approach each other closely.

Approach Problem Cautiously

It would be premature to conclude definitely that we may cause inclusions in aluminum-treated steel, through the introduction of oxide or by other means, to assume forms with the result that the metal is not injured. Future tests of regular or special nature might show some injurious influence of inclusions result-from degasification, however, the inclusions may be shaped and associated. Until more information is obtained on this entire subject, it seems clear that the development of cleanliness standards for steel, as indicated by the number and total volume of inclusions per unit of measurement, should be approached cautiously by those who make or use steel castings. The subject has practical rather than merely academic significance, because of the existence of private specifications which prescribe standards of acceptability according to the microscopically observed amount of inclusions in specimens taken from steel castings.

Liquid steel, always potentially subject to contamination causing porosity, on account of the many chances for contact with gas and gas-forming materials may be poured in certain portions of molds where design conditions are not conducive to the development of pin holes, while other members of the same castings or other castings poured from the same heat may be so designed as to be extremely susceptible to this troublesome defect. With a given condition of metal and kind of green sand used for the mold, certain castings are not likely to show porosity, while other castings are so shaped as probably to develop pin holes, unless extra precautions against the formation of porosity are taken.

A test specimen might be chosen from a casting member of such nature as to exhibit no porosity, while showing a condition of cleanliness as observed under the microscope, satisfying the requirements of some highly technical specification. Many castings covered by the purchaser's order might be so designed as to require extreme precautions in preliminary and final degasification for preventing porosity. The observed standard of cleanliness in one microscopic specimen might actually indicate, because of a small amount of inclusions in it, an inferior condition of the metal considered from the standpoint of its susceptibility to such small gas cavities as are favored by design factors. The inclusion index for satisfactory steel castings, dependent on the nature of the castings furnished, in reality may be an indication of inferior final treatment of the steel intended for some specific foundry application, although the metal might be highly satisfactory for other purposes. Final degasification can be performed in such manner as to represent effective inoculation against porosity, in the face of serious hazards to solidity.

Because there are and probably always will be held opposing views regarding such matters as inclusions in steel, frequently it is difficult to decide on the correctness of any opinion. Sometimes all persons concerned are partially right and partially wrong. In any case, it ought to be clear to steel foundrymen making high quality material that dependence alone on any final, effective degasifier may be an unsafe practice. Every feasible expedient should be employed for restricting to the smallest extent the formation of gas that may be taken up by the metal, and for providing adequate outlet for the gas that is produced.

Possibly some consumers would say that one obvious solution of this problem is to use among other expedients no mold materials that contain gas-forming constituents that can be discarded. Therefore green sand should be prohibited for the manufacture of steel castings desired to be practically or entirely free from porosity. Undoubtedly many classes of steel castings should be poured in thoroughly dried molds. The experienced steel foundryman required to make products of infinitely varied shapes, including many having designs of particularly susceptible nature in respect to shrinkage cracks, realizes that the substitution of baked sand for green sand for some steel castings ordinarily or occasionally would result in contraction defects more serious than those usually caused by pin holes. The present day steel founder, required to consider carefully his production costs, must keep in mind constantly such willingness to pay as the customer may manifest. Every detail of manufacturing cost must be considered, including the item of dry sand molding, which of course usually is considerably greater than that of green sand molding.

However we may view this entire question, it is perfectly obvious to the steel foundryman who serves customers expecting freedom from porosity in their castings that there is commercial justification for establishing and maintaining many practices to restrict the formation of gas in the mold, following the conditioning and transfer of the metal in such ways as to bring it to the molds in the minimum state of gas contamination.

This is the first of two articles by R. A. Bull, on porosity in steel castings. The second and concluding part will appear in an early issue.

THE EDITORS.

Approves Groups To Handle Complaints

Trade practice complaints committee of the railway brass car and locomotive journal bearings and castings manufacturing industry has been approved by the National Recovery administration as follows: F. A. Croft and W. H. Croft, Magnus Co., Chicago; J. B. Strauch, National Bearings & Metals Corp., St. Louis; Benjamin I. Kaufmann, Edna Brass Mfg. Co., Cincinnati; E. B. Vail, administration member, Chicago, Vernon B. Bates, secretary, 208 LaSalle street, Chicago.

Trade practice complaints committee of the Abrasive Grain industry has been approved as follows: L. M. Fuller, American Abrasive Co., Westfield, Mass.; F. L. Degener Jr., Keystone Emory Mills, Philadelphia; and W. A. Harty, The Exolen Co., Blasdell, N. Y.

To Rebuild Plant

Hill & Griffith Co., Cincinnati, foundry supply manufacturer, is replacing its Birmingham plant which was destroyed by fire recently. William Oberhelman, vice president and general manager of the company, has announced that the new plant will be built on the same site and will cost approximately $150,000.

ROYER PRODUCTS RECOMMEND THEMSELVES

One Group composed of **146** of the leading foundries in the United States and Canada are using

456 Royers

in the preparation of their foundry sand

An average of over **3 Royers** to each foundry

The use of a Royer for the preparation of your foundry sand will — — —

- save time
- save labor
- improve your sand conditions
- produce better castings
- produce cleaner castings

and assure you of a continuous supply of thoroughly mixed and aerated sand at an astonishingly low cost.

Talk over your sand conditioning problems with a Royer Sales Engineer

ROYER FOUNDRY & MACHINE CO.

158 Pringle Street ROYER PRODUCTS RECOMMEND THEMSELVES **Kingston Pa.**

Shortage of Skilled Mechanics

(Concluded from page 21)

and — so far as it's possible to gage them — what they'll be in the future. It will thus check an overproduction in skill in a given trade as it is now checking overproduction in commodities. Just as important, it will be in a position to keep the supply of skill in step with the varying demand.

"To the worker this means that the completion of his apprenticeship will be underwritten by many plants rather than by one. If business in the plant he's first assigned to takes a nose-dive there will be nine or 49 other plants, one of which will probably employ him. They are not readily going to scrap the one or two year investment they've made in him. More vital still to the worker, a temporary transfer to another plant, four times in five, is just what he needs to give him variety of experience when he can best afford to get it.

"The one-plant worker is the hardest man to find a job for today. Travel always helps the intelligent mechanic. Yes, I'll say it's going to be different all round."

All of which would smack of phophecy but for the fact that each year more manufacturers have handled their employment exactly as my friend sees them handling the training of men. They have formed associations, one of whose distinct functions is to obtain skilled help for their members.

Woodworking, printing, metal manufacturing, building are some of the groups in a score of cities that have maintained divisions which recruit workers, not only from local and outside sources but fill jobs in one member plant with men released by another.

Few of us appreciate how many mechanics the employment departments of individual plants daily refer to other plants for jobs. The employment managers of two of my city's keenest rivals have long called each other daily to check on the availability and whereabouts of hundreds of their skilled men.

A blanket proposal that men work two, three or four years at boys' wages to acquire a trade, will bring a roar.

"Why should I learn a trade? Look at my old man — and two brothers — and two of my sister's family. They all did. And what did it get 'em? God knows how long they've been out of work. Me learn a trade? I can make more driving a truck, rustling freight or bell hopping."

To overcome this state of mind industry must pay the learner a wage sufficient to attract and to hold him; or, pay the worker who has no trade and doesn't care to learn one a wage that will not draw from industry the type of worker which industry and the country most need.

Better Industrial Lighting Pays Its Way

By L. A. S. Wood

Westinghouse Electric & Mfg. Co.

Because better illumination does cut costs, increases efficiency, reduces accidents and establishes better working conditions, lighting in industrial plants everywhere will probably be revolutionized in the next few years. At present industrial lighting averages less than 5 foot-candles, one survey of 2000 industrial plants even averaging below 3, as compared with the safe minimum of 10 foot candles. Industry is awakening to advantages of better lighting as a result of recent developments in lighting and many industrial surveys.

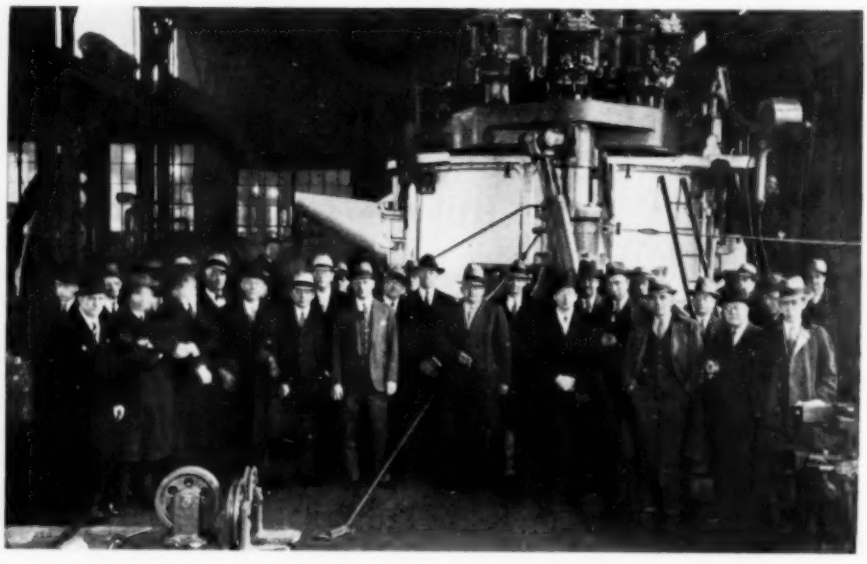
Development of the light meter which is a portable compact means of measuring lighting intensities, makes it possible easily and accurately to check intensity of light provided by artificial illumination in industrial plants everywhere. Illumination research laboratories have discovered by actual test that wherever eyes are used for work that 10 footcandles is an absolute minimum. Further tests have also revealed that working under intensities less than 10 footcandles causes not only severe eye strain but results in fatigue, sleepiness, nervousness, headaches, indigestion, etc. Glare from light sources in the line of vision, reflections from glossy surfaces and uneven distribution of light are also features which contribute to this condition.

But not only does better lighting mean increased production, it also means better work. Employes can see better, but equally important they have a more inviting, improved working condition and plant atmosphere. A dark, gloomy plant is depressing to workers and they cannot be expected to do their best in surroundings of this character. Better light will increase the morale of the entire staff to a pitch which assures good work, high efficiency. Also, workers are more dependable in well-lighted plants, and more satisfied to stay on the job—therefore, labor turnover is substantially reduced.

Improved lighting also means decreased accidents. Workmen who can see danger rather than merely sense it are less likely to be involved in accidents. Accidents in addition to their regrettable nature cost industries large sums of money year after year.

To Handle Sales In Southern District

W. J. Bach, 1400 Tenth place, South, Birmingham, Ala., has been appointed southern sales representative of the Cleveland Quarries Co., Cleveland, for the distribution of silica firestone and kindred products. Mr. Bach will cover the states of Tennessee, Georgia, Florida, Alabama, Mississippi, and Louisiana.



Pittsburgh Lectromelt Furnace Corp., Pittsburgh, recently held an open house to show a new top-charge, 20-ton direct arc type electric furnace built for the Huntington, W. Va., plant of the International Nickel Co. A duplicate of the furnace shown already is in use in that plant

Cupola Problems

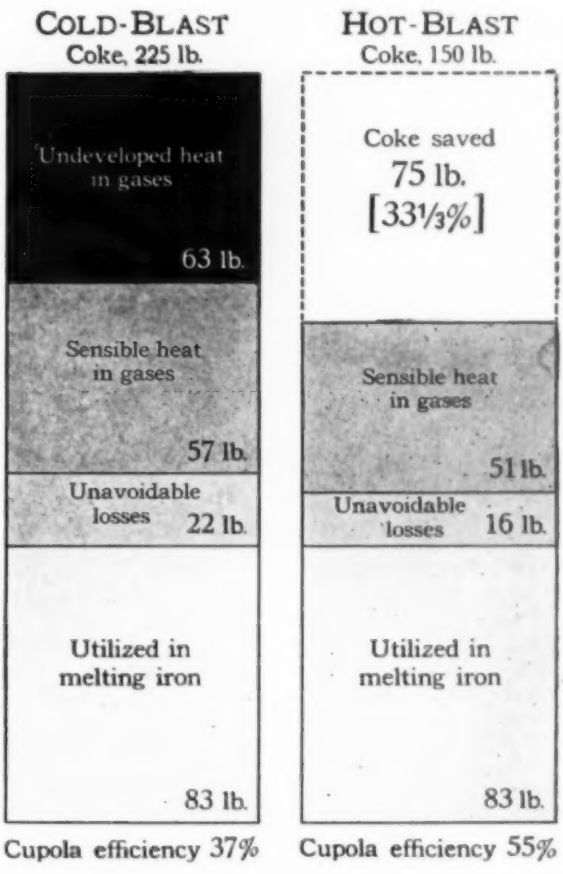
Problem No. 3—To get the *Same* Heat with *Less* Coke

Each pound of carbon in the coke fed to your cupola contains approximately 14,500 B.t.u. available for melting the iron . . . if it is burned to *carbon dioxide*. If incompletely burned to *carbon monoxide*, however, only about 4,380 B.t.u. are generated. The gases leaving the cupola contain a mixture of both carbon dioxide and carbon monoxide and their proportion between these two limits determines the heat liberated in the cupola to melt iron.

The waste gases from a cupola operated with the *Griffin hot-blast process* contain more carbon dioxide and less carbon monoxide than the gases from a cold-blast cupola. This is accomplished by the hot blast of about 600 deg. F., for which the heat is extracted from the waste stack gases.

The actual efficiencies obtained in many of our installations, through release of more of the available heat in the coke to melt the iron, show savings in coke per ton of melt of 65 to 75 lb.

Application of a *Griffin hot-blast process* to your cupola will substantially reduce your production costs. For full particulars, write our New York office referring to Cupola Problem No. 3.



THE AIR PREHEATER CORPORATION

Under Management of THE SUPERHEATER COMPANY

60 East 42nd Street, New York

Peoples Gas Building
CHICAGO

American Bank Building
PITTSBURGH

CANADA: The Superheater Company, Limited, Montreal

Represented in

Birmingham Boston Buffalo Charlotte Cleveland Denver Kansas City Houston
Memphis New Orleans Salt Lake City San Francisco Seattle Tacoma

A-936

Melting Control Reduces Losses

(*Concluded from page* 23)

the product is improved. But this is not all. Melting is more efficient and therefore less costly. Castings cost less because of lower melting cost and also because of reduced defectives.

Value of protecting metal while molten in the furnace against chemical action that may be detrimental has been recognized. There are those who would protect the metal from these effects by the use of fluxes or protective coverings. Such coverings are found helpful when for some reason the metal must be exposed to melting conditions for a long time, as for example, when melting borings (particularly dirty borings) or when the metal contains a high melting point element and the furnace is not capable of raising the temperature high enough to reduce this element quickly to a molten condition. Covering the metal with a slag or flux then may be helpful but it should be noted that any such covering tends to retard heat transfer to the metal and thus will increase the time required for melting.

Fluxes Serve Useful Purpose

However, fluxes are not to be condemned *in all cases*. They serve a useful purpose in the refining of metals. They are used in that process to dissolve ingredients in the molten metal that are not wanted. The right flux or slag intelligently applied is essential to the refining process.

When metal has been exposed to a furnace atmosphere wherein underburnt gases are present in sufficient quantity to cause trouble, the product is known as gassed metal. When this metal is poured into molds, and the resulting casting fractured, the fracture will exhibit a dirty structure, commonly called—burnt metal. When the castings are machined, they usually show holes that may be confused with blow holes from gases evolved from cores or molds. But the fracture will usually clear up any doubt as to whether these holes are molding defects or melting defects.

The author often has been asked the question, "When metal has been gassed, how can it be recovered?" The answer to this is as follows: Melt the gassed metal in an atmosphere that avoids gassing and the resulting metal will be sound, since the gases were released when the gassed metal solidified after the first melting.

It is not uncommon to find in the coke-fired, pit furnaces, used in many foundries that the oxygen supply is so inadequate that melting takes an unnecessarily long time. Thus the metal is exposed to furnace gases longer than if the condition were nearer ideal. To improve this, the drafts should be increased or the openings in the grate should be cleared to admit air freely, or perhaps both means should be employed.

The coke fired crucible furnace is nearer foolproof than other types, but is slow, and if the oxygen supply is insufficient, it is still slower and may cause gassing of the melt under the same atmospheric conditions.

A free flow of air to burners should be provided in the case of the oil fired crucible type furnaces and care must be taken to see that the proportion of air to oil is maintained at the most efficient point to insure complete combustion. Restriction of combustion space must be avoided and the furnace operator trained to maintain the correct atmospheric conditions.

The same requirements apply in the open-flame, reverberating type of furnace, but in an even more emphatic way, since the surface of the metal bath is washed by the flow of the furnace atmosphere, thus increasing the activity of the chemical action.

It is not uncommon to find a reducing atmosphere in the electric furnaces in the brass foundry, and consequent gassing of the molten metal. The correction for this is to supply air to burn this atmosphere to a condition of *slightly* oxidizing, even though this may increase electrode consumption.

In general, melting control will increase the efficiency of melting, reduce defectives and enable the foundryman to eliminate from his discussion melting troubles when defectives are studied for ways to improve the product.

Pour Castings Through Multiple Gate

(*Concluded from page* 27)

runners, etc., as to direction, position and inclination will conform to good foundry practice.

Gating arrangement for solid tappets is simplified to an even greater extent as illustrated in Figs. 10 and 12. Fig. 12 shows a partial floor of one-piece molds, each containing 32 tappets arranged in four rows, 8 to a row. Fig. 10 is a longitudinal section through one of the rows in the mold. The open runner on top delivers the metal directly into the top of each tappet mold. An individual runner is provided for each row and the metal is poured from a hand ladle. The jacket around the outside of the mold may be a regular flask part, a wood jacket or a metal jacket.

The 32 patterns are mounted on a pattern plate attached to a jolt-squeeze molding machine. An aluminum snap flask is filled with sand, jolted and squeezed. The squeeze board is equipped on the face side with a number of small projections which correspond to the number and position of the tappet patterns in the flask. After the board has been removed the molder cuts four runners in the sand with a straightedge equipped with four small scoops on the lower edge. The pattern plate then is vibrated and lowered away from the flask, after which the molder lifts the flask from the machine and places it on one of the chill plates provided for the purpose. The snap flask is removed and replaced with a jacket. No weight is required to hold the mold on the plate. The face of the plate is painted with a highly refractory aluminum paint which prevents the formation of rust.

Book Review

General Metallurgy (Allgemeine Metallkunde), by E. Piwowarsky, paper 6¼ x 9½ inches, 248 pages, published by Verlag Gebrueder Borntraeger, Berlin, Germany, and supplied by The Foundry, Cleveland.

This book, written in German, was prepared in an endeavor to present general valid relations for metals and alloys in an easily understandable, yet modern scientific manner, and to attack only in special cases the technical fields of application to illustrate from them some possible characteristic examples for the basic relations. To that end the subject matter has been divided into 10 main sections or chapters covering various phases. The first is on metals as crystalline, anisotropic substances and discusses phase rules and the process of crystallization, further influences on crystallization and grain form, and space diagrams of the elements. The second describes fundamentals of alloying and includes space lattices of solid solutions and chemical combinations, binary constitution diagrams, examples of technically important constitution diagrams, and ternary constitution diagrams.

Properties of melting are discussed in the third section while the fourth is devoted to procedure during freezing or solidification including such phases as contractional and liquid shrinkage, hot cracking and casting strains, crystal segregation, ingotism, inverse ingotism and gas blows. The fifth chapter describes gas solubility of metals and alloys, and the sixth presents data on the mechanical properties of metals and alloys. Crystal normalization and recrystallization processes are presented in chapter seven, and hardening and heat treatment phenomena are described in chapter eight. The ninth and tenth chapters are devoted respectively to corrosion of metals and alloys, and to physical properties.

Harbison-Walker Refractories Co., has acquired the American rights to the forsterite patents covering refractories made of olivine and other magnesium silicates.

ADVERTISING PAGES REMOVED

Molybdenum in Gray Cast Iron

(*Concluded from page 25*)

cent molybdenum is being used in many of the chilled rolls made for the steel industry. Its effect is valuable in that it toughens the iron causing it to retain its smooth surface longer between dressings and also in its deep hardening effect whereby more redressings can be applied before scrapping the roll. Our experimental laboratories have but recently developed a series of white irons to meet a great variety of applications.

Consistent hardnesses of over 600 brinell are obtainable on the chilled surface, with considerable toughness. The analysis can be varied to give a depth of chill of at least 10 inches, to a ¼-inch chill with machinable gray iron within ½-inch of the chilled surface.

Molybdenum in amounts from 0.50 per cent up has a tendency to retard the annealing in the malleable process. This can be overcome by the addition of a graphitizer such as silicon, nickel or copper. One development includes the addition of molybdenum to produce a shorter cycle malleable iron. This is done by raising the silicon content substantially, while still obtaining a hard iron casting. Although brief, the information so far available on molybdenum malleable iron is encouraging enough to instigate further experimenting by several large malleable iron producers in the United States and abroad.

Changes Properties

MOLYBDENUM when added to gray cast iron in certain definite amounts, affects the properties in a marked manner. This article, which is from a paper presented at the June meeting of the Connecticut Foundrymen's association at Meriden, Conn., points out that molybdenum has a strong effect on the growth resistance and high temperature strength of the iron, increases machinability, provides increased wear resistance, improves uniformity of structure, etc.

The author is metallurgical engineer, the Climax Molybdenum Co., New York.

Effect of Molybdenum On Three Types of Cast Iron

	Molybdenum, per cent	Tensile strength, pounds per square inch	Transverse strength, pounds	Brinell hardness number	Machinability rating according to type
Cylinder iron	.....	29,000	3500	198	Good
	0.35	38,000	4400	208	Very good
Piston iron	.....	28,000	3300	201	Good
	0.80	41,000	4700	213	Very good
Die iron	.....	40,000	4800	235	Good
	1.00	56,000	6400	285	Good

Book Review

The Founding of Aluminum (La Fonderia d'Alluminio), by Carlo Panseri, paper, 582 pages, 6½ x 9¼ inches published by Ulrico Hoepli, Milano, Italy, and supplied by THE FOUNDRY, Cleveland.

This volume which is published in Italian presents a detailed account of all the various phases connected with the founding of aluminum and its alloys. The book is divided into four parts, and contains 20 chapters. It opens with a historical account of the discovery of aluminum and its later development into a commercial industry. The first part of the book deals with pure and commercial aluminum and their physico-chemical characteristics; theory of aluminum alloys; melting and solidification of aluminum and its alloys; characteristics and general properties of aluminum alloys; effect of temperature upon characteristic aluminum alloys, and method of investigation and control of castings first by physical and mechanical tests, and second by physical and mechanical tests, and chemical examination.

Part II relates to technical or commercial aluminum; preparation of alloys and rich or mother alloys; commercial alloys of aluminum; aluminum alloys for special purposes such as resistant to corrosion and resistant to heat, and aluminum as an element of secondary importance in founding. Part III deals with furnaces for melting and heat treating aluminum, treatment of aluminum in the liquid state, founding, for deoxidation and degasification, and loam and sand for molding of aluminum.

The fourth part considers the choice of one alloy and its economical manufacture; pouring of aluminum in loam molds; pouring aluminum in metal molds, and preparation and finishing of the castings. An appendix contains the A. S. T. M. standard method for chemical analyses of aluminum and its alloys, and the new standards of the British Standards institution for aeronautical materials. Also at the end of each chapter a bibliography of literature relating to the subject in hand is appended.

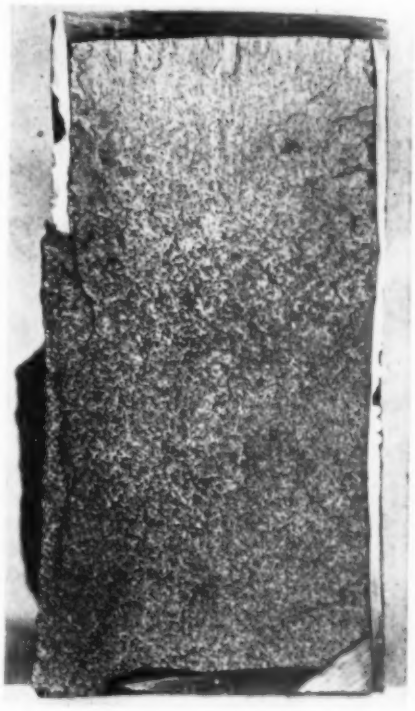


Fig. 7—Typical fracture of chilled iron which contains molybdenum

Publishes Book On Mineral Production

United States department of interior, bureau of mines, recently has published "Minerals Yearbook, 1934", edited by O. E. Kiessling, chief economist, division of mineral statistics. The first part is devoted to a review of the mineral industries, a discussion of the status of the mineral industries, a statistical summary of mineral production, and a discussion of mineral production in foreign countries. Part two is devoted to metals and presents information and data on production and use of all of the various metals. Part three treats nonmetals and part four discusses mine safety.

This valuable reference book may be purchased from the superintendent of documents, Washington, for $1.75.

Hold Cores To Close Tolerances

(*Continued from page* 30)

The ovens occupy a space approximately in the center of the core room with ample space between the line of oven doors aad the wall for the use of a number of electrically operated trucks engaged in carrying loaded core racks into and out of the ovens. A similar space separates the two lines of doors on the two inside batteries which face each other. The entire floor of the core room, including the wide area surrounding the core ovens, is surfaced smoothly with cement to facilitate operation of the trucks, particularly while the cores are in the green state.

Body cores are made in a type of metal corebox that has been adopted universally throughout the automotive foundry industry. It is made up of a base and four detachable sides held in place by rapidly adjusted clamps. It is the product of a new school of patternmakers, men who combine a working knowledge of foundry requirements with the technical and manual skill of the metal die sinker. Where the old time patternmaker talked with proper respect of sixtyfourths and referred to a hundredth with bated breath, particularly in the presence of apprentices, these men talk carelessly about thousandths of an inch. It is only when ten thousandths are specified on the dimensions that they begin complaining about the ingrained cussedness and crabiness of designers in general — then they work to the 0.0001-inch tolerance.

Place Arbors in the Cores

The corebox is set up on the bench with the barrel end resting on the base plate. A perforated pipe arbor is dropped into each barrel, where it is centered by a small knob or projection on the plate. The new sand mixture is shoveled in and rammed by hand as high as the crankcase part of the corebox which then is filled with the old sand mixture. A rectangular metal frame is forced into this sand to serve as an arbor. Additional sand is heaped in the box, rammed down and then scraped off flush. Outside members of a multiple venting device are inserted in guides on the outside of the corebox and the vent wires are forced a predetermined distance into the core. A plate is clamped in place and the assembly is rolled over in a small yoke suspended from an air hoist. The coremaker removes the base plate — now on top — and places it once more on the bench. Then he rapidly releases the clamps, after which each of the four sides in turn is removed laterally and the entire set is reassembled on the base.

An attendant brushes water on the cope face of the crankcase core and attaches a sheet of thin paper 5 x 7 inches on the central area. He also adjusts a small cap jig on top of the barrels which remains in place until the core is dried. The core then is placed on a light frame suspended in a wood box containing liquid blacking. While the frame and core remain stationary the box is raised by a small hoist and the core is submerged. The box is lowered and the core is lifted out and placed on a rack for removal to the oven. The sheet of paper is removed, leaving a bare or unblacked area on the upper or cope face of the core. Experience has shown that blacking on this area is conducive to cold shuts.

A special device is employed to prevent manifold cores from parting at the point as they sometimes do when made in the usual manner in a two-part corebox and then booked. The lower half of the core is made in the usual manner in a half corebox. An upper half box without any top then is placed in position and filled with sand. This half is removed and the true half box is placed over the mound of sand and rapped down into place. This half then is lifted off and replaced by a dryer shell. The assembly is inverted and the former lower half box is removed leaving the core resting in the dryer.

Strainer cores to the number of 25 are made in a metal corebox consisting of three flat plates mounted on a rollover machine. One plate contains the circular openings, the second is a stripping plate, also the bottom of the box, and the third plate has the pins which form the perforations in the cores. With the device in operating position, the cavities are filled with sand and scraped off flush. A flat core plate is adjusted in place and the assembly is rolled over. By an ingenious cam arrangement the lower plate and pins are drawn away from the stripping plate before the half arc of the circle is completed. The plate containing the cores is lowered away from the machine, which then is reversed. On the return journey the plates come together with the pins once more projecting through the stripping plate.

Cores Tested in Jigs

Dried body cores for the cylinders are tested for accuracy of shape and general dimensions in a two part metal frame or jig provided with contact points corresponding to all points where the core touches the sand in the mold. The core is placed in the drag half of the frame and the operator, with one swift glance, notes whether or not it rests perfectly. With a vent wire he breaks away any film of sand that may have formed over any of the various vent openings. He then lowers the cope half of the frame into place and notes how it fits. Occasionally a core is discarded, but usually the cores pass through in a steady stream.

Disk grinders are employed to surface the joint side of the jacket cores and a revolving brush is pushed through the openings. Progressive assembly is practiced here as on the mold conveyors. Cores are passed from hand to hand so that each employe may perform his or her share

(*Concluded on page* 62)

Fig. 11 — Cylinder head cores pass in constant procession through a horizontal surface grinder

CLEVELAND
Superior Built
VIBRATORS

Sizes and Types
For All Purposes
CORE, MOLDING & SHAKEOUT

•

Most Completely Equipped
Plant For Repairing
All Makes of Vibrators at Low Cost

•

CLEVELAND VIBRATOR CO
2100 Superior Ave W., Cleveland, Ohio

CERTIFIED!
Steel Abrasives

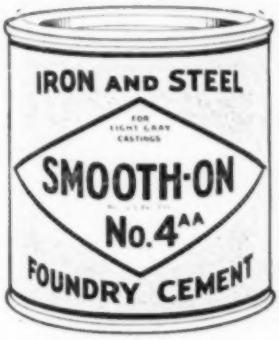
WILL MAKE 1935
A HAPPY AND PROSPEROUS
NEW YEAR

for those who specify these famous abrasives for their BLAST CLEANING jobs. CLEAN QUICKER because they're SHARPER. WEAR LONGER because they're HARDER. MORE EFFICIENT because they're ECONOMICAL AND DUST-FREE.

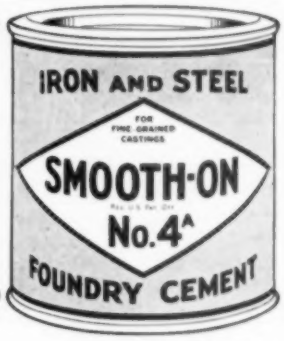
Resolve to try "CERTIFIED" Steel Abrasives—NOW.

PITTSBURGH CRUSHED STEEL CO.
PITTSBURGH, PENNA.
STEEL SHOT AND GRIT CO.
BOSTON, MASS.

FILLING COMPOSITIONS
for *perfect* match of surface
color—lustre—texture—contour



Smooth-On No. 4AA
For light gray castings and machined surfaces. Has high metallic lustre. Takes fine machine finish.

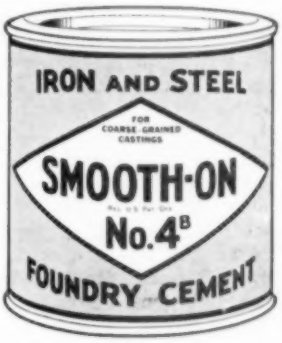


Smooth-On No. 4A
For medium gray castings. A fine grained cement that has a good metallic lustre.

THESE three Smooth-On compositions, each with its own distinct color, degree of lustre and fineness of grain, are now available to the foundryman for filling surface blemishes, pits, porous spots, etc., in iron and steel castings of any shade, appearance and quality.

With these three Smooth-On Cements you can match the shade and lustre of any casting.

This achievement makes the surface corrections undetectable, and adds significant efficiency to Smooth-On treatment.



Smooth-On No. 4B
For dark gray castings. A cement of coarser grain and darker shade.

Smooth-On No. 4 AA, Smooth-On No. 4 A and Smooth-On No. 4 B are decidedly the best for foundry requirements.

Castings judiciously treated with Smooth-On look better and are worth more. *Take advantage of this new Smooth-On development*, and give it a fair test on your own product.

FREE
HARDENED and WORKING
SAMPLES

Smooth-On Nos. 4AA, 4A and 4B packed in 1-lb. and 5-lb. can, 25-lb. pail or 100-lb. keg. Mail coupon for prices and free hardened and working samples.

Smooth-On Mfg. Co., Dept. 17,
570 Communipaw Ave., Jersey City, N. J.

Please send *working* samples of
Smooth-On ☐ No. 4AA Smooth-On ☐ No. 4A Smooth-On ☐ No. 4B
☐ Hardened samples of all three.

Name.....
Address.....
.....
1-35

***Do it with* SMOOTH-ON**

(*Concluded from page* 60)

of the allotted task. In this manner each employe becomes exceedingly expert, confusion is avoided by stacking the various cores along the benches and the entire process is speeded up to the pace set by the fastest worker in the group. Also, each worker in turn becomes an inspector of the partly assembled cores as they come to his or her hands, from the immediately preceding worker in the line. Where necessary cores are pasted, wired, or held in position by pouring a small quantity of lead into cavities provided for the purpose. The assembled cores are placed in a vertical type oven where the blacking, paste and daubing material on the joints are dried.

Since the melting and molding features have been touched upon previously, the next logical point of departure for further description is the shakeout. After the molds are filled with metal the conveyor carries them under a hood where most of the smoke and steam are removed by a powerful exhaust fan and discharged through the roof. At the end of the line molds are shaken out over gratings in the floor. Sand is returned to the storage hopper. Flasks and plates are returned to the molding stations and the smaller castings are discharged into a large, perforated revolving metal drum set at a slight incline, and thence to buckets on overhead conveyors or trailer trucks which convey them to the cleaning department. Piston castings are loaded in steel buckets suspended from a conveyor. Four buckets are placed upon a turntable below the discharge end of the drum. As each bucket is filled it is raised by pneumatic hoist and hooked to the conveyor. The turntable is swung horizontally through a quarter circle and an empty bucket replaces the one that was taken away.

Castings are cleaned in a battery of 120 tumbling barrels and a number of sandblast installations through which the castings pass on conveyors. Grinding wheel stands are set up at various points on the floor. Cylinder head castings are fed on to a conveyor which carries them through a special grinding machine which removes metal simultaneously from the top and both side faces.

This is the last of four articles dealing with the Chevrolet foundry of the General Motors Corp., Saginaw, Mich.

THE EDITORS

Book Review

Industrial Standardization, Its Principles and Application, by John Gaillard, cloth, 123 pages, published by H. W. Wilson Co., New York, and supplied by THE FOUNDRY, Cleveland, for $2.00 and in Europe by the Penton Publishing Co. Ltd., London.

Evidence collected by the author tends to show that the degree to which industrial standardization has been adopted by manufacturing establishments in the United States as a systematically applied managerial function represents only a small fraction of what might be expected in view of the benefit which may be derived from its application. The discussion presents valuable information on the four major phases in which standardization work may be carried out, namely, within the company, by trade association or technical society, under the procedure of a national standardization body, and on an international scale.

In an historical sketch covering the evolution of standardization, in which types of standards and the human factors entering into the consideration are outlined, the author presents studies on essential functions of industrial standardization, a definition and characteristics of a standard, normal values and limits, development of the practical application of standardization work. A chapter dealing with the standardization of a manufacturing concern stresses the problem of co-ordinating different activities which permit the formulation of certain principles to be observed in organization and in carrying out industrial standardization in practice.

Chicago Section Discusses Forehearths

Cupola forehearths provided the chief topic for discussion at the December meeting of the Chicago section, American Foundrymen's association. George S. Evans, metallurgist, Mathieson Alkali Works Inc., New York, was the principal speaker, presenting the paper he delivered at the annual meeting of the American Foundrymen's association in Philadelphia on the subject, "The Forehearth as Used in Iron Foundry Practice".

Mr. Evans described the different types of forehearths and pointed out the advantages of each. He also discussed various objections to the use of the forehearth. Importance of selecting the right kind of forehearth for the particular use to which it is to be put was emphasized. A fore hearth greatly simplifies the desulphurizing process.

Two speakers shared the program of the meeting of the Chicago section held at the Medinah Athletic Club, Jan. 3. Dan M. Avey, editor, THE FOUNDRY and president elect of the American Foundrymen's association spoke on future trends and outlook in the foundry industry for 1935 and C. E. Hoyt, executive secretary, outlined the larger field of service of the association. D. J. Reese, Whiting Corp., Harvey, Ill. presided.

Publishes Study On Cast Light Metals

American Society for Testing Materials has published a report on "Service Characteristics of the Light Metals and Their Alloys" which represents a two-year project on the part of members of A.S.T.M. committee B-7 on light metals and alloys, cast and wrought, with the American Foundrymen's association co-operating, especially on material relative to casting alloys. The publication is arranged in four parts, namely metallurgical characteristics, industrial requirements, surface protection and tabular data.

The section devoted to metallurgical characteristics deals with a discussion of chemical composition, heat treatment, welding, etc. The section on industrial requirements evaluates the usefulness of light alloys in certain fields including aircraft, automotive, general structural and architectural work, railway equipment and household appliances.

The actual work of compiling this data and information was in charge of a committee consisting of A. L. Boegehold, General Motors Corp.; D. L. Colwell, Stewart Die Casting Corp.; W. H. Dix Jr., Aluminum Co. of America; J. A. Gann, Dow Chemical Co.; J. B. Johnson, Material Section, Material division, Air corps, U. S. A.; H. S. Rawdon, National bureau of standards; and Sam Tour, Lucius Pitkin, Inc. T. D. Stay, Aluminum Co. of America served as representative of the American Foundrymen's association.

Copies of the report may be secured from either association for 50 cents per copy.

Speaks on Cupola At New England Meeting

Y. A. Dyer, Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., was the principal speaker at the regular meeting of the New England Foundrymen's association held Dec. 12 at the Engineers' club, Boston. Mr. Dyer spoke on "Cupola Practice", including the important phases of charging, blast and pressure volume, coke, fluxing, and measurement of temperature. He presented valuable information on the production of good castings.

Appointed Manager

Allan Seymour, sales engineer of the grinding wheel division, Norton Co., Worcester, Mass., has been appointed manager of the Philadelphia office. Ralph M. Johnson, formerly district manager, takes over the duties of sales engineer in Worcester.

DUST

RUINING INDUSTRIES

For over thirty years the Pangborn Corporation has been saving industry from the dust menace that threatens its very existence. A boon to both men and machines, Pangborn Dust Collectors have become standard equipment in practically all manufacturing processes—collecting destructive dust at its very source. The new "CH", an all metal, cloth screen, Dust Collector of highest efficiency, is recommended for both large and small jobs. Write for free Bulletin.

PANGBORN CORPORATION

WORLD'S LARGEST MANUFACTURERS OF BLAST CLEANING AND DUST COLLECTING EQUIPMENT

HAGERSTOWN MARYLAND

PANGBORN

Sole Manufacturers of

PAXSON FOUNDRY EQUIPMENT

formerly built and sold by J. W. Paxson Co. and the Titgen-Eastwood Co.

We have the complete PAXSON patterns and are prepared to furnish repair parts promptly

NRA WE DO OUR PART

THE TABOR MANUFACTURING COMPANY

6225 TACONY ST., PHILADELPHIA—PENNA.

THAT LADLE FLUX WE'RE USING NOW ISN'T SO BAD, IS IT?
PLENTY GOOD. WE'RE GETTING SOME REAL RESULTS IN THE FLUIDITY OF THE IRON
SOME OF THE LAST IRON POURED WAS DEAD IN APPEARANCE, BUT RAN THREE-EIGHTH-INCH SECTIONS VERY NICELY

FLUXES *for*
ALUMINUM
BRASS
BRONZE

Ladle Flux for
CAST IRON

SPECIAL FLUXES *for* SPECIAL ALLOYS

THE MALUMINUM COMPANY TRANSPORTATION BUILDING NO. 263 INDIANAPOLIS, IND.

System Saves Money on Supplies

(*Concluded from page* 31)

modity making up the total expenditure.

Several years ago we started monthly detailed analyses of stores consumed, showing each foreman in detail how the total charge against his shop for stores was made up. Generally speaking, almost any class of expense, that has not been closely examined, analysed, discussed and overhauled, can be reduced 10 per cent through the exercise of reasonable care. As our monthly stores cost runs into a large sum, the estimated savings looked almost ridiculously optimistic. In the first year, not only did the results surpass these estimates but far exceeded them. The stores cost was 13.9 per cent lower than for the preceding year. The second year showed a further reduction of 4.4 per cent or almost 18 per cent if compared with the costs of the year prior to the economy drive. Subsequent periods all show additional savings.

Co-operation Reduces Waste

While some of the apparent saving is attributable to lower prices paid for certain commodities, the greater part is due to the genuine interest taken by our works organizations and their wholehearted co-operation in the elimination of waste in the use of shop supplies.

In determining the savings, the cost of stores per unit of production was used, and as production dropped, with the general recession in business activity, we know that the money value of the economies made actually is understated. The decrease in dollars and cents value of stores consumed is considerably greater than the savings claimed.

At first a foreman's usual reaction on reading the stores analysis was one of astonishment, mingled with a sincere belief that the "guys in the office" had made a mistake. He couldn't possibly have used $80.00 worth of this and $210.00 worth of that, or spent the hundreds of dollars on supplies that, unfortunately the tabulations revealed.

Little thought is needed to realize what a changed attitude this ray of light can develop in a foreman. He is a busy man, keeping production running through his shop, attending to calls for assistance or advice from his men, supervising the activities of his men, trying to get this piece of work out on time, occasionally harassed by a breakdown of a crane or the other machinery. Amid all this, requisitions for incidental stores are pushed before him for signature. Is it any wonder he is likely to forget that his signature authorizes the spending of money, especially when he is unaware of the amount he is spending?

All requisitions do not call for cotton waste, or hacksaw blades. Many involve large sums. There is a tendency to overlook the fact that stores are money. A foreman with little hesitation will sign a requisition for $5.00 worth of goods. A prevalent belief seems to be that anything in the supply house can be used without cost as it is already bought. This seems to be the popular conception of accounting and cost finding.

However, if responsible employes can be made to realize that stores represent value just as dollar bills represent value, if they can become *cost minded* the possibilities for savings are enormous. In one large plant as many hacksaw blades were used in a month as now are used in a year. Formerly the machine shop drew them from the storehouse by the box but today they are issued one or maybe two hacksaw blades at a time as needed.

Even in companies supposedly well managed, inadequate stress is placed upon the need for stores economies. The most efficient routine for the actual purchase of supplies and the best organized purchasing department conceivable will ensure only that the call for the goods is proper, that they are bought at an economical price and that inventories are not excessively large. The past few years have seen an enormous improvement in the organization of purchasing departments in centralizing the function of buying under one head. The most rigid control over buying does not prevent or disclose directly the wasteful use of the articles bought.

Stores Represent Money

Peculiar as it may seem, many employes react unfavorably to the word *economy*. The expression *elimination of waste* is suggested in its place. True economy and parsimony are as far apart as the poles. Emphasis should be given to the point that economy consists not in doing without essentials but in doing without the *too much*. If the foremen can be made to realize that signing a requisition is equivalent to signing a check, the truth that stores are money will be brought home in simple but emphatic fashion.

At one plant a large board bearing a comprehensive assortment of supplies was erected in a conspicuous place. Underneath each item was marked in bold type the price the company paid for it. The list included an emery wheel, a hacksaw blade, a shovel, a bucket, a hammer handle, a riddle, and a dozen or more other commodities.

At a foremen's meeting at which the subjects stores consumed came up for the usual weekly airing, it was an education to hear the discussion. Without exception, these firing-line bosses admitted they had not realized the cost of the multiplicity of stores items used so constantly. Confessions of ignorance were coupled with expressions of determination to watch every single requisition for stores in the future, to eliminate all unnecessary demands and to impress upon each of their own men the value of miscellaneous supplies.

From the savings already mentioned, we know that a genuine and successful effort has been made to avoid waste. The procedure has resulted in a saving of scores of thousands of dollars in the past few years. The very fact that a monthly analysis is made has led to a jealous guarding of the authority to sign stores requisitions at the works, and has helped to impress upon those given the authority, the importance of the trust the company reposes in them, and how they, within the scope of their duties, are individually responsible for wasting or saving the company's funds.

Publishes Report On Nonmetallic Resources

The U. S. Department of commerce, bureau of mines, recently has published part II on nonmetals of *Mineral Resources of the United States*, 1931. The report was prepared by O. E. Kiessling, chief economist, division of mineral statistics of the bureau, and covers a wide variety of nonmetals including fluorspar, cryolite, potash, fuller's earth, talc and soapstone, abrasive materials, sulphur and pyrites, silica, clay, magnesium, stone, coke, cement, etc. The work may be obtained from the superintendent of documents, Washington, D. C., for $1.

Appoints Representatives

Steelblast Abrasives Co., Cleveland, has appointed George F. Pettinos, Inc., Philadelphia to handle the sales of the company's metallic abrasives in Pennsylvania, New Jersey, and Delaware.

M. A. Bell Co., St. Louis has been appointed to handle the sale of the company's products in the St. Louis area.

W. F. Haggman, Syracuse, N. Y., has been appointed sales representative in Eastern New York for Steelblast company. Mr. Haggman succeeds Charles Meyn, who died recently.

Mathieson Alkali Works, New York, recently moved its offices to 60 East Forty-second street.

ADVERTISING PAGES REMOVED

Thus does youth learn from age

The Adventures of Bill

BY PAT DWYER

IN A SHORT discussion the other night on whether heredity or environment is the principal factor in the development of a child's character, Bill boldly maintained that at birth, every infant may be compared to a clean sheet of paper. The record appearing thereon from year to year is through outside influence, the effect of contact with and impressions gained from those with whom the child associates.

Waving aside my feeble protest to the effect that blood will tell and that many a beautiful and saintly character has flourished in the Roaring Third, Hell's Half Acre, The Jungle, or otherwise appropriately named localities where the monster of vice flourishes like the well known bay tree, he proceeded on his way as calmly as one of these modern trucks that crowds you into the ditch on the main highway.

"By nature," he said, "every child is innocent, candid, frank and truthful. He tells the truth on all occasions and as a natural corollary he believes what he hears or reads. After he has been gypped a few times—cruelly deceived to you—he becomes tough himself. One thing leads to another and he finally winds up either broke in the penitentiary, or as a retired Public Enemy No. 1, with barrels and barrels of filthy lucre in the local bank.

"Occasionally, a strong, sterling character—the present speaker, for example—learns to separate the wheat from the cockle and thus escapes the fate of the two lads in the foregoing parable."

"Do not be over hasty," I interrupted. "You have several years yet—I trust—in which to qualify."

"You trust, eh? Well, I trust your trust is more trustworthy than mine was the first time my innocent faith and trust were violated by a venerable old gent with a long white beard, a cane and a snuff box. I think he must have been the last of the snuffers. The term of course is applied here in the proper or technical sense and means a person who gustily inhaled snuff through one or both nostrils, as opposed to the more modern interpretation of the term. This latter type, I sadly feel, always will remain to afflict us.

"At that particularly interesting period of the world's history I had progressed sufficiently to walk upright, to drink out of a cup or saucer and to read all about how 'Jack-has-got - a - cart - and - can - haul - sand - and - clay - in - it' in the beginner's book prescribed by the National board of education. All of which is just another way of saying that I was five years old, going on six and therefore in a position to swallow avidly anything either in the shape of food or information.

"One one memorable occasion this hoary old wolf in sheep's clothing, a long tailed frieze coat with bone buttons and a pair of homespun pants, held up a brass pin between the snuff stained index finger and thumb of his right hand and bade me mark the apparent insignificance of the object. Having secured my undivided attention he solemnly assured me 'that it takes 10 men to make a pin, just one single pin.'

"Possession of that priceless piece of exclusive and inside information gave me a feeling of superiority over other small boys in the everlasting disputes and debates which mark all small boy gatherings. I knew something which was away and beyond their limited scope of knowledge.

"Pride goes before a fall. Mine received a cruel jolt one day when I paraded this gem of knowledge in the presence of my mother. She smiled—I never have seen any person who smiled as easily and adorably as my mother—she smiled at my little exhibition of vanity. She asked me where I had picked up the information and then explained that while old Tom had told the truth, he only had told part of the truth. At that period the pin making machinery was not quite so automatic as it became in later years and a crew of ten men attended the various machines through which the pins passed in the manufacturing process. Which is a long way from saying that ten men are required to make one pin.

"In my innocence I had assumed that every morning the boss arranged his ten men in a circle, tossed a piece of brass into the center and told them to fall on and make a pin. Naturally I had not the faintest idea of how the work was done, but as-

The coach throws a little pep talk into the boys

sumed in a general way that the black, whiskery group, bare armed and leather aproned did things with a fire, an anvil, tongs and large heavy hammers. The local blacksmith shop probably was responsible for this deduction. Every day on the way to and from school I lingered by the door of this mysterious cavern where the presiding genius welded chains, shod horses and aujusted flaming steel tires on wooden cart and carriage wheels. My little inquisitive nose gratefully inhaled the ordor of burning wood, but the pungent, penetrating, piercing, acrid smoke which arose when the red hot shoe was applied to the sizzling hoof usually sent me flying. Boy! That was some smell.

"Talking about horses reminds me of another incident in the long list which gradually converted me from a true believer into the hard boiled individual who regards every statement with suspicion. A boon companion of my youth, and therefore one in whom I reposed the most implicit confidence very kindly offered to show me an amazing freak of nature. I often wonder where this despicable type of snake in the bush gets his peculiar sense of humor.

"According to this philanthropist, his father had come into possession of what without doubt was the most remarkable horse in this or any other country. It had the usual number of legs and other features, but the head was where the tail ought to be, and the tail was where the head should be. Th' old man intended to charge admission and hoped to reap a modest fortune from exhibiting the freak. Since I was a particular friend, I could have a look absolutely free gratis for nothing.

"Clearly this was an opportunity I could not afford to miss. Here, I reflected is a real pal, one of these lads who grapples you to him with hoops of steel. A little later I kind of figured that hoops was a typographical error. Any grappling I would do in the future would be with hooks, good sharp hooks, with barbs in 'em.

"How come, sez you. Well, here's how come. The horse, an ordinary old dingy white skate was standing in the stall with his tail in the manger and his head facing us!"

"All very interesting," I admitted, "but these were all childish experiences. Grown men do not indulge in that kind of nonsense. If they did their hearers would laugh at them."

"Well," said Bill, "I'll tell you. I read a short article in a magazine recently describing the repair of a 3-ton cast iron forging machine head by welding. The statement was made that a new casting would have cost $1000. The welding job cost $200, a clear and distinct saving of 80 per cent. What is still more remarkable, the work was done so perfectly and accurately that it was not necessary to even scrape the bearings when the machine was reassembled.

"The casual reader gathers two main impressions, both wrong of course, but still he gathers two main impressions from this statement. First, that gray cast iron apparently is at the very least, a semiprecious metal and second, that the welding process will mend anything and everything at minimum cost.

The oldest profession in the world

"Let us see to what extent these impressions are justified.

"It would be interesting to know by what extraordinary flight of imagination the writer decided that the casting would cost $1000, or, at the rate of 16.6 cents per pound. Certainly, many foundrymen accustomed to receiving 3 or 4 cents per pound for their gray iron castings in the rough and 8 or 9 cents for the machined product, will be deeply chagrined to learn that they have been asleep at the switch while customers have been shouting offers of 16.6 cents. Is it possible that the millenium has arrived with the New Deal?

"Do you think the statement was made with what is known in legal circles as mental reservations? This is a polite and technical method of telling the truth, but not necessarily all the truth. In the light of this supposition the $1000 prize is simply unassailable. In this assumed amended form the statement might read: 'A new casting would have cost $1000, machined, nickel plated, wrapped in swansdown and cellophane and shipped by airplane to Borneo, Timbuctoo or Antofagasta, or, by mule train and the old covered wagon over the Oregon Trail to the Pacific coast.'

"Unfortunately, this supposition is nullified by the information that the repair was effected in a Midwest welding shop, presumably for a local customer. This factor automatically eliminates the c.i.f.; c.o.d.; f.a.s.; and f.o.b. expense factors and brings us back, as you might say, to the cost of the casting on the hoof.

"On the second count, the claim for coverage and economy, kind of shrinks up a little under more rigid scrutiny. Magnifying certain factors while minimizing others represents legitimate practice in works of fiction and in the drama as it is portrayed on the stage and screen. The audience expects this distortion and therefore is not deceived. Serious statements are not accepted on this basis.

"The same argument used to prove the substantial saving effected by welding an old casting as compared to buying a new one could be used by a foundryman to prove that he could do the job at a fraction of the welding cost by the foundry process known as *burning on*. If the customer was willing to accept a patched casting, the foundryman could do the work at a cost of about two hours of labor and the cost of melting from 1 to 2 tons of iron, a total cost of approximately $10.

"Finally, the story would carry more weight if it was written — say — a month after the patched casting was placed in service. To confirm my own opinion I wrote to several manufacturers of heavy machinery for an expression of opinion on this extraordinary story. The president of one company replied:

I find that a new pattern, new casting and all the machining including the over head would come to $580.00. This makes the casting complete with a reserve pattern in case replacement ever was needed. The last paragraph in the article which states that the work was done so accurately that it was found unnecessary to even scrape the bearings before putting the machine into service, is so romantic that I can make no comment. The writer of this article fails to state that the broken pieces of the crown are only held together by the outside edges of the broken pieces where the steel studs are imbedded in the surface. This would reduce the capacity of the crown, I would say 50 per cent or more. The entire article as I read it seems more like a romance of the South Seas, rather than actual engineering practice.

"The president of a second company wrote that: 'The pattern and casting could be made at a good margin of profit for $500.00.'

"While it is true that in recent years, welding equipment and technique have been developed to a remarkable extent, it also is true that the men in the metal working industries are fairly familiar with the advantages and disadvantages of the process. Consequently they sprinkle a few large grains of salt on palpably exaggerated statements and com-

(*Concluded on page* 72)

Cut Your Costs!

NO MORE BROKEN FLASKS WHEN YOU USE

Cannon

Interchangeable

Pins & Bushings

Being short they eliminate ear wear and breakage.

They prevent shifting of the drag and hold the cope in perfect alignment.

They reduce flask scrap.

They are used as standard equipment in the world's largest foundries.

Easily installed at moderate cost. Write for descriptive circular.

MADE ONLY BY

FEDERAL

Screw Works

Sole Licensee

Detroit, Michigan

GOULAC

Carload Shipments from ERIE, PA.

DRY BINDER

ROBESON PROCESS CO.

AMERICAN GUM PRODUCTS CO.

230 Park Ave. New York

Stocks at

Birmingham, Ala.	Detroit, Mich.	New Haven, Conn
Boston, Mass	Holyoke, Mass.	Philadelphia, Pa.
Buffalo, N. Y.	Indianapolis, Ind	Pittsburgh, Pa.
Chicago, Ill.	Milwaukee, Wis.	St. Louis, Mo.
Cincinnati, Ohio	Minneapolis, Minn.	Toronto, Ont.
Cleveland, Ohio	Newark, N. J.	Montreal, Que.

Ellwood

FOUNDRY NAILS

Light, strong, economical. Serrated to provide extra grip on the sand. Extra large heads insure against breakdown of mold during pouring. If you have been using ordinary nails for this purpose, start using Ellwood Foundry Nails because they go three times as far.

Ellwood Foundry Nails are available in sizes from ½" to 8".

Makers of foundry nails for 20 years!

Order from your local foundry supply house or direct from us.

ELLWOOD STEEL CORPORATION

Ellwood City, Pa.

(Pittsburgh District)

GLUTRIN

Carload Shipments from Ausable Forks, N. Y. and Erie, Pa.

LIQUID BINDER

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

High Test Irons

Practical Data for the Manufacture of High-Duty Cast-Irons, (Donnees Pratiques pour la Fabrication des Fontes Resistantes) by A. Le Thomas. *La Fonte*, Bulletin of the French Center of Foundry Research, Paris, June, 1934.

This article, which covers 40 pages, offers those founders, who have no special scientific training, practical suggestions for producing high-duty cast-irons. This is of spcial interest in view of the incerasing demand for high-duty iron brought about by a number of industrial developments.

One of the most important factors is the correct selection of raw materials. The silicon content in the iron is itself of primary importance; the percentage varying in accordance with the thickness of the casting and ranging from 1.80 to 1.20 for thicknesses from ¼-inch to 1¾ inches. Percentage of carbon is less important. About 2.5 per cent carbon in the iron charged in the cupola should give a carbon content of about 3 per cent under good conditions, or even 3.4 per cent, in the casting, which is satisfactory. Sulphur should be less than 0.10 per cent, and manganese should reach from 0.7 to 0.9 per cent.

Phosphorus generally should not exceed 0.30 per cent. Special additions, such as nickel, chromium, etc., may be required when special qualities are wanted in certain given circumstances.

In addition to the chemical analysis, care also should be exercised in selection of materials from the point of view of structure and origin. Irons containing large graphitic cavities are to be avoided. Not more than 30 per cent of iron containing coarse graphite grains should be used in the charge. Steel scrap should not be added directly, but should be melted previously into pigs or ingots, mixed with hematite iron. A white or mottled iron can be used, provided it is of the correct chemical composition and has been obtained under normal melting conditions.

Calculation of the charges going into the cupola is another important factor and is related to the average thickness of the castings wanted.

Special selected irons, made in the blast-furnace under strictly-controlled conditions, and further treated in the electric furnace, now are available and can be used with practical certainty of a precise chemical analysis. The silicon content in particular is scaled, so that various percentages are available for different kinds of castings. Carbon is about 2.5 per cent; manganese 1 per cent; phosphorus does not exceed 0.07 per cent, except if a higher percentage is required for thin castings, and the sulphur content is very low. Such an iron can be used direct, without mixing any other form of iron or steel, and castings thus have been obtained with a homogeneous structure, a tensile strength exceeding the most severe specifications, while the shearing test gave from 43,000 to 48,000 pounds per square inch, and the static transverse test from 1650 to 1875 pounds.

When such special pig iron is not used alone, a simple formula is recommended using a mixture consisting of 25 per cent of scrap originating from similar castings, 25 per cent of specially-prepared iron, 25 per cent of steel scrap remelted with hematite iron, and 25 per cent of pure hematite iron. Each constituent is chosen in relation to the average thickness of the casting. For a given average thickness, the types of iron scrap and special irons are fixed definitely, but control can be effected by modifying the selection of steel scrap and hematite iron.

As regards the method of preparing a mixture of steel scrap and hematite iron, the object is to obtain a product containing a small amount of silicon to control the percentage of silicon in the cupola charge. Such a mixture generally comprises 50 per cent of current steel scrap, 25 per cent of ordinary hematite iron containing 2.5 per cent silicon, and 25 per cent of hematite iron containing about 2.5 per cent silicon and from 2 to 3 per cent manganese. The use of scrap coming from spring steel should be avoided.

Considerable attention should be given to the stocking of iron, scrap, etc., in separate bins or bays. The cupola should be operated hot. Various charges should be arranged in horizontal layers.

The last chapter deals with testing and control, first by the founder during the process of manufacture; secondly from the point of view of the user. In the first group of tests, the inverse chilled cast is recommended (THE FOUNDRY for August, 1934, page 60). In the second series of tests the brinell hardness, static transverse and shearing tests are recommended.

Casting Practice

Manganese Bronze and Brass, by Wesley Lambert, Foundry Trade Journal, London, Dec. 13, 1934.

Composition of manganese bronze generally is within the following limits: Copper, 50 to 70 per cent; aluminum, traces to 5 per cent; tin, traces to 1½ per cent; iron, traces to 2 per cent; manganese, traces to 5 per cent; nickel, traces to 3 per cent; and zinc, the remainder.

Lead, arsenic, bismuth, antimony, and sulphur, even in small quantities are undesirable constituents. Manganese bronzes used for industrial purposes, fall into three categories, distinguished by their microstructure. These three classes are designated: Alloys of alpha structure; alloys of alpha-beta structure; and alloys of beta structure. The author discusses the characteristics of the three phases.

Since manganese bronze is one of the most difficult alloys to cast, it is essential that the founder have a well-balanced alloy, skilfully compounded under strict supervision both as regards temperature and melting conditions. Moreover, the alloy must be of such a composition as to not only meet specification requirements in respect to mechanical tests, but must have, as far as possible, desirable properties of a good casting alloy, without which successful foundry production cannot be assured. The author discusses in detail the procedure which should be observed in the founding of manganese bronze.

MODERN

Covered and Insulated Ladles—

will guarantee you

Uniform Hot Metal

They will enable you to handle larger amounts of metal; to save the "drop" in the ladles which previously was "pigged"; to protect your men from the heat and gases of the ladle, thus making for better labor conditions.

In the foundry here shown, the alloy iron in the one ton covered ladle lost only 40° of heat after having been transported 400 ft. and poured into hand ladles for 7½ minutes. Rigid inspection of sand, cores, and molding methods means little without the metal temperature control afforded by these improvements.

Open, obsolete ladles are costing you money daily. Send for our ladle catalogue L-34 and details on ladle covers and insulation.

MODERN EQUIPMENT CO.

PORT WASHINGTON, WIS.

Dept. 108

hotel Sinton CINCINNATI

700 ROOMS WITH BATH AND SERVIDOR

$2.00 PER DAY AND UP

$1.00 PER DAY EXTRA FOR ADDITIONAL OCCUPANT OF ROOM

75 MODERN SAMPLE ROOMS WITH BATH OR SHOWER AT $2.50 TO $5 PER DAY

Greatest Hotel Value in CINCINNATI

A minute from everywhere... All bedrooms and suites modernized. ..Headquarters for the exclusive Town Club and Racquet Club.... A vital part of Cincinnati's polite Social Life...Successor to Cincinnati's famous old St. Nicholas Hotel...The city's Quality Hotel.

Finest of Fine Foods

Dining Rooms ..Cafeteria Lunch Room..Coffee Shop and the renowned Sinton Cocktail Cafe reborn.

HOTEL SINTON ST. NICHOLAS

RUEMELIN SAND BLAST CABINETS

(Patented)

Have proven most practical in service. More than 500 in use — Durably constructed — Lowest Maintenance cost — Simple to operate — Moderately priced — Sanitary in operation.

Showing cabinet with Front door closed

The large front door swings open for quick access to inside of cabinet.

Particularly well adapted to the requirements of brass and aluminum foundries.

No time is wasted as operator is not required to walk to rear of cabinet for loading or unloading.

Get our quotations on Cloth Bag Dust Filters, Sand Blast Rooms, Generators, Abrasive elevators.

RUEMELIN MFG. CO.

1587 S. First St. Milwaukee, Wis.

Obituary

FREDERICK F. STOCKWELL, 71, a founder, president and treasurer of the Barbour-Stockwell Co., Cambridge, Mass., and for many years secretary of the New England Foundrymen's association, died in Boston, Dec. 22. Mr. Stockwell was a native of Brattleboro, Vt., and went to Boston as a boy to become a machinist's apprentice. At the age of

Frederick F. Stockwell

21 he was taken into partnership by his employer under the firm name of Barbour, Stockwell Co., operating a foundry and machine shop at Cambridge, producing forgings and castings, and specializing in railroad equipment. Mr. Stockwell was an honorary member of the National Metal Trades association, treasurer of the New England Street Railway club, president of the West Somerville, Mass., Co-operative bank. He is survived by two sons, Ernest and Howard, the former active in the management of the Barbour-Stockwell Co., and also by two daughters and 11 grandchildren.

* * *

Elmer E. Miller, 73, president, Stark Foundry Co., and Canton Stoker Corp., Canton, O., died at Canton recently.

* * *

M. S. Ketchum, 62, dean emeritus of the college of engineering, University of Illinois, Urbana, Ill., died Dec. 19. Dean Ketchum was graduated from the University of Illinois in 1895 and at one time was contracting manager for the American Bridge Co., Kansas City. Later he became dean of the University of Colorado, college of engineering; administrative director of the government's powder plant at Nitro, W. Va.; and professor of civil engineering at the University of Pennsylvania. From 1927 until his retirement last year, Dean Ketchum was associated with the University of Illinois.

* * *

James Watson, 75, formerly superintendent of foundries, Otis Elevator Co., New York, died at his home in Yonkers, N. Y., Dec. 19. Mr. Watson was retired.

* * *

William W. Macon, 59, for 23 years identified with the editorial department of the *Iron Age*, and during 14 years of that period managing editor and editor in chief, died in New York, Jan. 1.

* * *

John A. Schultz Jr., 50, president of the Schultz Die Casting Co., Toledo, O., died Dec. 27. Mr. Schultz founded the Schultz Co. in 1930, and prior to that time was vice president and general manager of the Doehler Die Casting Co.

* * *

Fredolf J. Peterson, 49, Detroit district representative, Electric Furnace Co., Salem, O., died at his home in Detroit, Dec. 2. Mr. Peterson was born in Sweden and came to this country when 17. He had been associated with the Electric Furnace Co. for the past 15 years.

* * *

Michael J. Carroll, 59, connected with the Ohio Steel Foundry Co., Springfield, O., died at his home on Nov. 17. Mr. Carroll was born in Smith Falls, Canada, and previous to his connection in Springfield, was employed by the Hubbard Steel Foundry Co., East Chicago, Ind.

* * *

Walter MacLeod, 61, president of the MacLeod Co., Cincinnati, manufacturer of sandblast equipment and foundry supplies, died at his home Dec. 18. Mr. MacLeod was one of the early sandblast equipment manufacturers in this country, and was well known as an inventor and designer. He also was British vice counsel for southern Ohio.

* * *

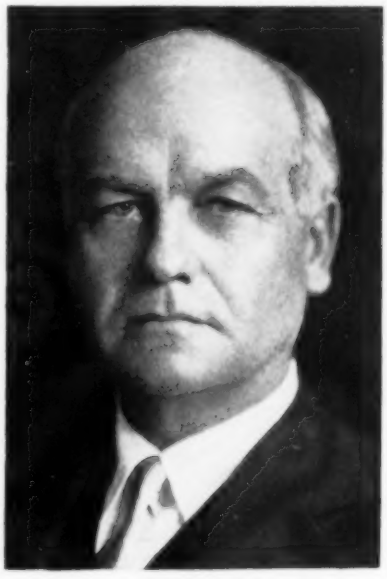
David Rees Bowen, vice president, Farrel-Birmingham Co. Inc., Ansonia, Conn., died at his home Dec. 29. Mr. Bowen entered the employ of the Farrel Foundry & Machine Co. in 1883 as a machinist's apprentice. After serving his apprenticeship for 3 years he worked as a machinist for 2 years and then entered the drafting room of that company. Later he was made chief engineer, a position which he held until 1930 when he was made vice president.

* * *

William H. Winslow, 78, former member of the firm of Winslow Bros., Chicago, manufacturers of ornamental iron and brass fittings, died at his home near South Haven, Mich., Dec. 24. Winslow Bros. was formed in 1887 and played an important part in the early use of metal in the structural as well as the ornamental phases of building work. The company was dissolved in 1922.

* * *

Frank J. Ottis, a part owner of the Northern Malleable Iron Co., St. Paul, and one of the leading citizens of that city, died Jan. 5. Mr. Ottis was a lawyer by training, and was active in



Frank J. Ottis

civic affairs and politics. During the war he represented the malleable iron industry in its contacts with the War Industries board.

The Adventures Of Bill

(*Concluded from page* 62)

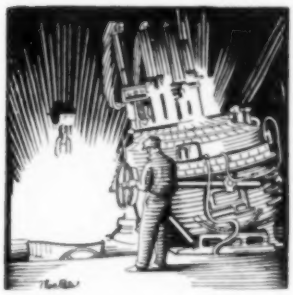
parisons. In the present instance any competent foundryman could have delivered the casting, machined and ready for use for approximately $500. When it comes down to the final analysis, the confidence placed in a new casting, as opposed to the doubt regarding a patched casting, is worth every cent of the difference in price."

"You seem to think," I said, "that a welded or patched casting does not merit that degree of confidence which a man naturally reposes in a brand-new, solid, one piece casting."

"Listen, my lad. An artificial bond is only an artificial bond. A man and a woman are bonded in the holy state of matrimony by the words: 'What God has joined together, let no man put asunder.' If this bond, forged by the hand of the Omnipotent Creator himself may be broken so easily — see any newspaper, any day — what chance has a man made job?"

ADVERTISING PAGES REMOVED

New Equipment



For Foundries

Twisted Stem Chaplets Have Four Edges

Federal Foundry Supply Co., 4600 East Seventy-first street, Cleveland, has introduced a line of square twisted stem chaplets which may be secured with either single or double heads. Four sharp edges extending the entire length of the stem facilitate fusion of the chaplet stem. The twisted design provides 3¾ inches of knife-like fusion edge for each inch of chaplet height, thus providing a good surface for the molten metal to fuse, it is claimed.

The head is electrically welded to the stem

Head of the square twisted stem chaplet is electrically welded to produce a one-piece unit. The chaplet is especially recommended by the manufacturer for hydraulic and high pressure castings where perfect fusion and no leaks are necessary, in heavy castings where strength is needed, and for small castings where only a small amount of metal is provided to fuse around the chaplet.

A view of the single head, square twisted stem chaplet is shown in the accompanying illustration.

Oil and Grease Seal

National Motor Bearing Co., Oakland, Calif., has developed a new oil and grease seal applicable to all types of machinery embodying shafts. The seal excludes extraneous matter and holds in oil and grease.

The seal consists of an outer steel case which locks the seal assembly permanently. An equalizing annular garter spring within the case provides a uniform continuous contact, pressing against the sealing member at all points on the circumference.

Comparator Used for Spectographic Analysis

Bausch & Lomb Optical Co., Rochester, N. Y., has introduced a new density comparator, an instrument designed for accurate and rapid quantitative spectrographic analysis. The unit is built as an accessory instrument to any spectrograph. Intensities of spectrum lines are measured by photoelectric means and the result is read directly from a scale. The equipment is free from the personal equation of the operator and the effects of fatigue which limit the accuracy of measurements made with visual photometers. Computations can be made at once without waiting for the development of a photographic paper or film.

The equipment consists of a projective system, a photoelectric cell for reception, a voltage regulator, and a sensitive galvanometer. The current for the standard unit is 110 volt, 60 cycle, alternating current. Provision is made for other voltages and frequencies.

The instrument is built as an accessory to any spectograph

Finds Moisture Content of Sand Sample

Harry W. Dietert Co., 676 West Grand boulevard, Detroit, recently has introduced an instrument for determining the amount of moisture in a sand sample. The moisture teller will dry a 50 gram sand sample at 212 degrees Fahr. in 45 seconds. The sand sample is weighed before and after drying. The unit needs no calibration and is not affected by condition of the sand. The device consists of a cast aluminum base upon which a motor driven blower is mounted to force air over an electric heating element. The heated air flows through the sand sample since the sample on which moisture is being determined is contained in a pan having a monel metal filter cloth bottom. The sand pan is held against the bottom flanged portion of the air tube by a spring loaded holder.

Three sand pans are supplied with the unit to permit the operator to weigh sand samples while the unit is drying a sample. Moisture determination may be made on any granular material such as molding and core sand mixtures, clays, coal dust, flour, and refractory mixtures.

Furnace Roof Temperatures Controlled

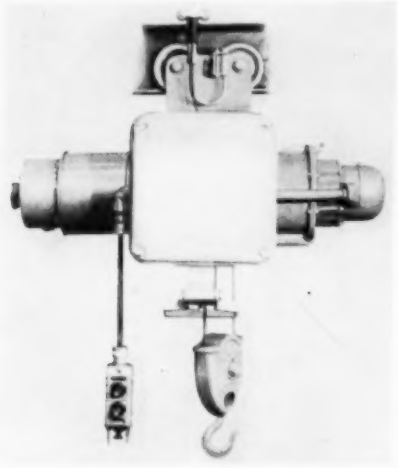
Leeds & Northrup Co., 4901 Stenton avenue, Philadelphia, has introduced a new temperature-limit control for furnace roofs. It is pointed out that the control is three-fold protection against excessive roof temperatures.

It swings a big black arrow around a giant white dial which can be seen from 200 feet across the charging floor. The unit records roof temperature on a circular chart and also reduces the fuel automatically if the roof is threatened and turns it on again as soon as the roof is safe.

No alterations in furnace structure or changes in method of operation are necessary in installing the temperature-limit control.

Hoist Controller Provides Five Speeds

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y., has introduced a selective, five speed, push button controller which is said to make complete control of hoist or crane possible. The five speeds are



Increasing or decreasing thumb pressure changes the speeds

controlled from one button. The operator, increasing the pressure of the thumb, feels the change as each of the five independent speeds is obtained when the button is pressed or released. The first is a creeping speed. Each of the succeeding four speeds gives a gradual increase of torque. By releasing the button gradually the motor is slowed down through the same graduated speeds to a stop.

All five speeds are usually obtainable for lowering, regardless of the load. In hoisting, however, the percentage of rated load lifted determines the number of speeds available. Thus, full loads will not move upward until the push button is pressed to the third or fourth point.

Other features claimed for the controller include compactness and adaptability of mounting, similarity of construction and control features for both alternating current and direct current. Control is built in two sizes, one being rated at 3 horsepower and the second at 7½ horsepower.

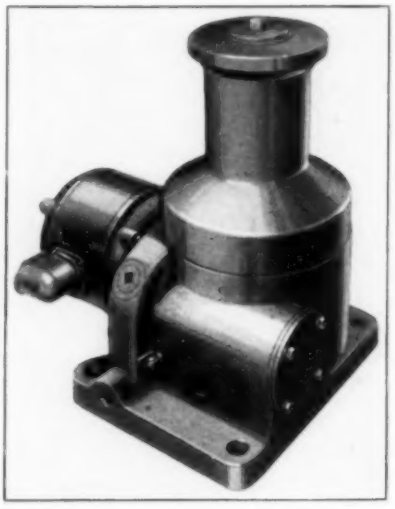
Molding Machine Built Above Floor Line

Tabor Mfg. Co., 6225 Tacony street, Philadelphia, has introduced a new semi-shockless, jar, hand trunnion rollover, gravity pattern drawing molding machine. This unit, which is shown in the accompanying illustration, is designed for production work. The machine is built entirely above the floor line and therefore does not require a pit. It is built in three sizes having 13, 15 and 18-inch squeeze cylinders, with ample jarring capacity to take care of any load suitable to the respective sizes. The machine is equipped with vibrator and rollers for rolling the completed mold from the unit conveniently.

Motor Attached Direct to Housing

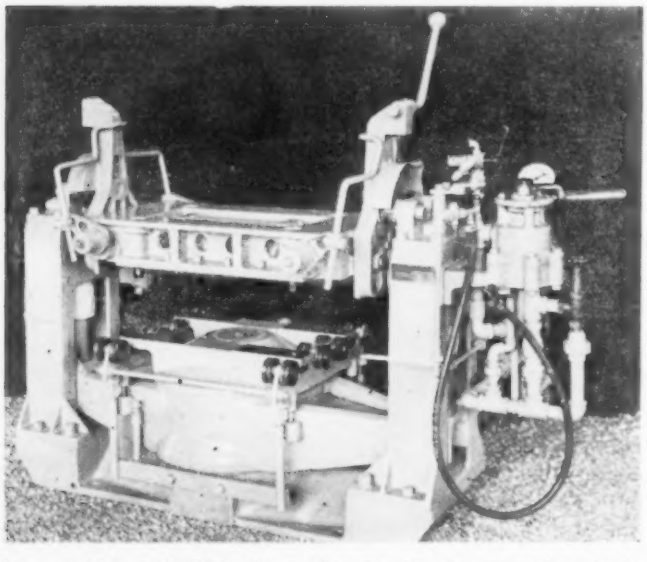
Link-Belt Co., 910 South Michigan avenue, Chicago, has changed the design for its vertical-capstan electric car spotter so that the motor is attached direct to side of spotter housing, with the result that no motor shaft coupling or separate motor base plate is required. With motor bolted to side of the spotter housing, as shown in the accompanying illustration, proper initial and permanent alignment of motor shaft is secured; and the plan measurements of foundation required are a minimum.

The motor shaft extends into a substantial one-piece housing, which contains all gears — a helical-gear reduction at motor, and a worm-gear set. The gears run in oil, and are readily accessible. The motor is of high-torque fully enclosed type, and can be removed as a unit complete with motor pinion, without disturbing the rest of the machine. The motorized spotter is available in two sizes. The smaller machine has a rope



The motor shaft extends into a substantial, one piece housing

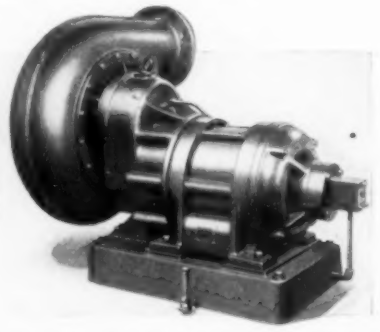
pull of 5000 pounds, and the larger size, 10,000 pounds.



The machine is built in three sizes having 13, 15 and 18-inch squeeze cylinders

Drives Compressor Through a Gearmotor

A new exceptionally compact centrifugal compressor or turboblower, which makes use of a gearmotor, has been introduced by the Allis-Chalmers Mfg. Co., Milwaukee. By using the gearmotor for speed increase, the blower can run at higher than motor speeds, thus reducing dimensions and it is claimed, improving performance.

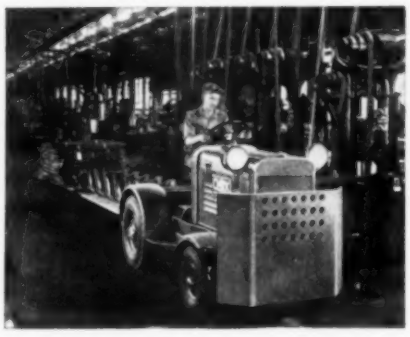


The gearmotor permits the compressor to be driven at higher than motor speeds

Pressures from 0.75 to 3 pound gage are developed, the volumetric capacities corresponding to motor outputs from 3 to 30 horsepower. The units have application for foundry cupola blowing, oil and gas fired furnaces, pneumatic conveying, agitation and aeration, etc.

Industrial Tractor Made in Three Models

Clark Tructractor Co., Battle Creek, Mich., has introduced a new all-purpose industrial tractor, which may be obtained in three models. The unit has a 46 horsepower, 6 cylinder power plant, and special gear ratios in double reduction rear

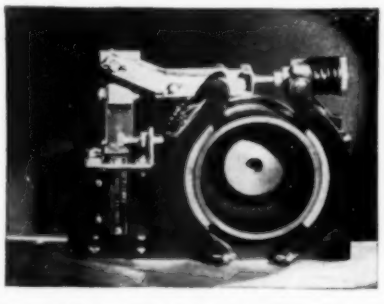


The tractor is powered with a 46 horsepower, 6 cylinder gasoline engine

axle provide a wide range of speeds to handle various types of service. The maximum speed is 18 miles per hour. All models have a self-starter, generator, battery, electric horn, front bumper plate, eye coupler, pneumatic tires, and lights are available if desired. The tractor is shown in the accompanying illustration.

Provide Large Brake Lining Area

A new line of alternating current and direct current solenoid operated brakes recently has been announced by Cutler-Hammer Inc., Twelfth and St. Paul avenue, Milwaukee. The brake wheel is relatively large, permitting low total brake shoe pressures, which, distributed over the large brake lining area, result in low unit pressure on the lining and therefore long, even wear of the friction surfaces, it is claimed. The low shoe pressure also is said to result in low stresses on all pins and pivot points, to provide longer wear, and to allow the use of a small operating



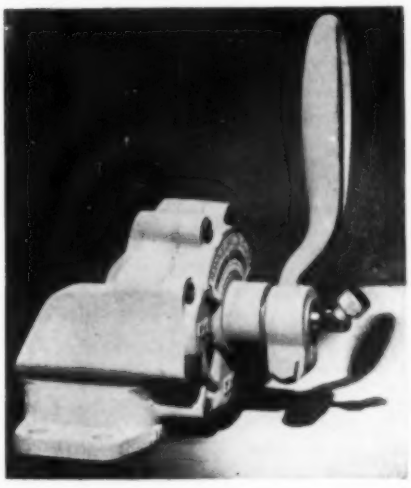
The wheel is relatively large to permit low total pressures

solenoid which requires less current.

Dimensions of the alternating current and direct current brakes are interchangeable so that the machine designer can provide standard mounting holes and apply either brake as needed. Brake shoes use molded brake lining.

Designs Valve for Compact Installations

Hanna Engineering Works, 1765 Elston avenue, Chicago, has introduced a manifold valve which is said to be particularly adaptable to installations where a number of valves must be located close together. The necessary piping to and from valves is possible without interference with the piping of adjoining valves. Valves of the manifold type may be arranged so the intake and exhaust openings are connected conveniently to a single



Both disk and seat wear uniformly across the full diameter

supply or exhaust pipe either directly or with a manifold or pulpit block.

Between reversals the valve disk rotates on two eccentric points while in contact with the seat. Circular lines of contact or scoring, it is claimed, do not develop. Both disk and seat wear uniformly across their full diameter. Balanced disk pressure throughout contact area is secured by arrangement of the seat ports and disk pockets. The valve disk is seated on the valve bonnet so that renewals may be made without removing the valve body from the pipe line or disturbing pipe connections or valve mountings.

Firms Consolidated

Brown Instrument Co., Philadelphia, has been consolidated with the Minneapolis - Honeywell Regulator Co., Minneapolis, and will be operated as a subsidiary of that company.

Welding Goggles Have Special Ventilation

Chicago Eye Shield Co., 2300 Warren boulevard, Chicago, has introduced a welding goggle which, it is claimed, while adequately ventilated is designed to prevent foreign particles or light from entering the eye cups. Special air channels in the edge of the cup under the lens, and large side ports make possible normal cir-

Screw caps allow easy changing of welding lens

culation of air currents within the goggles. This makes the equipment comfortable and eliminates fogged lenses.

Screw caps allow easy changing of welding lens or cover glass and a new type rubber-covered, ball-chain bridge permits adjustment without twisting the cups. Elastic headbands are adjustable to size.

Introduces Line of Angle and Globe Valves

A new line of renewable bronze, angle and globe valves has been introduced by the Fairbanks Co., New York. The radial seat between the body and bonnet is designed to give a tight joint and perfect alignment of all parts. The disk ring is composed of long fibre asbestos, compounded with vulcanizing elements and given a special cure.

The disk holder is of standard dimensions, permitting the use of other standard makes of disk rings if desired. All parts of globe and angle valves are interchangeable.

Radial seat is designed to give a tight joint on the valve

HIGH QUALITY FLEXIBLE SHAFTS AND MACHINES

Strand
FLEXIBLE SHAFTS

WE HAVE MET THE TEST FOR THIRTY YEARS

FLEXIBLE SHAFTS and MACHINES

⅛ to 2 H.P.—Sixty types and sizes

1-1½-and 2 H.P. Machines

¼ to 2 H.P. vertical types

Thousands of purchasers are still convinced they bought the best when they selected the "STRAND"

Type M5A-⅛ H.P.

Type MP5 Metal Pattern Makers Equipment

We have issued a very interesting catalog of 64 pages. You may have a copy. Write us.

N. A. STRAND & CO.

Manufacturers

5001-5009 No. Lincoln Street — Chicago, Ill.

"BRANFORD" VIBRATORS

Vibrator Flask Rapper
(above)

Vibrators for all Foundry uses
From ⅜" Plate Vibrators
to
8" Flask and Table Vibrators.

Valves, Fittings, Automatic Oilers—Complete Vibrator Fittings for Benches, Moulding Machines and Tubs.

New Department for Servicing Branford and Any Other Make of Pneumatic Vibrators.

Write for Catalog or Vibrator Information —Dept. 46

MALLEABLE IRON FITTINGS CO.
Branford, Conn., U. S. A.

HANNA PIG IRON

—dependable uniformity

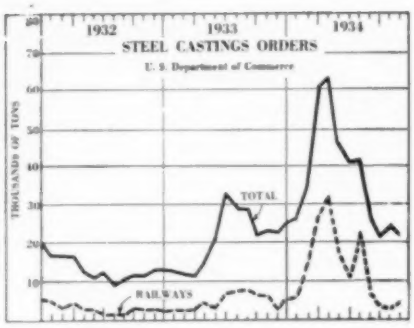
BRANDS:
Buffalo—Detroit—Susquehanna

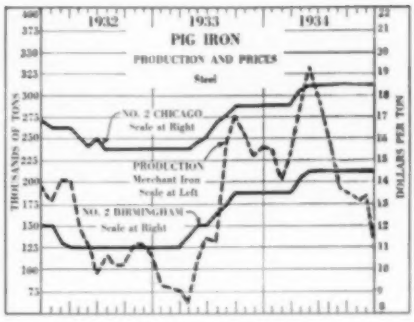
•

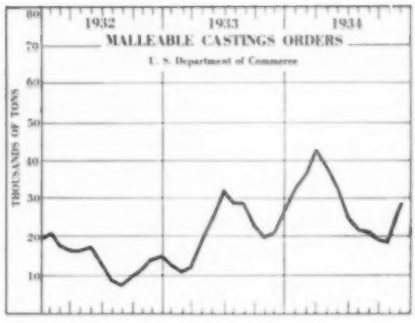
GRADES:
Foundry—Malleable
Silvery—Ferro-Silicon

•

The HANNA FURNACE CORP.
MERCHANT PIG IRON DIVISION
OF NATIONAL STEEL CORP.
Buffalo, New York — Detroit, Mich.
New York — Philadelphia — Boston







Foundry Activities

Reflect Industrial Trends

CARSON FOUNDRY & MFG. CO., Tecumseh, Mich., recently was incorporated for $25,000 with the following officers: President and treasurer, D. J. Carson; vice president, Glenn L. Williams; secretary, J. D. Carson. The company will specialize in gray iron castings, and also will manufacture stock feed cookers, tank heaters, etc. The plant is now operating at about 60 per cent of capacity.

* * *

Saginaw Malleable Iron Works, Saginaw, Mich., plans a factory addition.

* * *

Superior Foundry Co., Cleveland, recently received a loan of $200,000 from the RFC.

* * *

Foundry buildings of the Plano Foundry Co., Plano, Ill., recently have been undergoing repairs.

* * *

Foundry of Laughlin Marine Hardware Co., 103 Foster street, Peabody, Mass. has been closed permanently.

* * *

William Moser, one of the partners in the Bluffton Foundry & Machine Co., Bluffton, Ind., has purchased the interest of Ray Ash.

* * *

Canastota Mfg. Co. Inc., Syracuse, N. Y., has been organized to produce castings by Russel E. Harrington, University block, Syracuse.

* * *

Fairbanks Morse & Co. recently announced a modernization and rehabilitation program at its Beloit, Wis. plant to cost more than $100,000.

* * *

Kalamazoo Stove Co., has provided an addition to its enameling plant at a cost of $15,000 according to Arthur L. Blakeslee, president. The company reports a steady increase in business.

* * *

Novelty Foundry & Iron Works, Inc., 9 Wallace street, Sterling, Ill., has been incorporated by Jessie A. Burleigh; Mabel H. Burnham and Mabel J. Haberle, to manufacture gray iron castings.

* * *

National Bearing Metals Corp., 364 Ninth street, Jersey City, N. J., recently purchased a two-story warehouse building 100 x 150-feet at Brunswick and Tenth streets, Jersey City to provide additional facilities and space.

* * *

Sanford Foundry Co., Sanford, N. C., recently was opened for business by H. R. Kellam, formerly of Biscoe, N. C.

RAW MATERIAL PRICES
Jan. 8, 1935

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$ 5.10 to $ 5.35
Wise county beehive coke	4.30 to 5.30
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$12.50 to $13.00
Heavy melting steel, Pitts	13.00 to 13.50
Heavy melting steel, Chicago	12.00 to 12.50
Stove plate, Buffalo	8.75 to 9.25
Stove plate, Chicago	6.50 to 7.00
No. 1 cast, New York	7.00 to 7.25
No. 1 cast, mchy., Chicago	11.25 to 11.75
No. 1 cast, Pittsburgh	14.00 to 14.50
No. 1 cast, Philadelphia	11.00 to 11.50
No. 1 cast, Birmingham	9.50 to 10.00
Car wheels, iron, Pittsburgh	12.50 to 13.00
Car wheels, iron, Chicago	12.50 to 13.00
Railroad malleable, Chicago	13.00 to 13.50
Malleable, Buffalo	11.00 to 11.50
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	7.50
Straits tin	50.55
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary)	16.00
Lead, New York	3.70
Antimony, New York	13.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.75

The plant is affiliated with the Suggs Bros. Machine Shop on Market street, and is located in the buildings of the former Moffitt Iron Works Co.

* * *

Gray iron castings production in the Philadelphia Federal Reserve district during November, according to a recent report of the industrial research department, University of Pennsylvania, declined 20 per cent. Malleable iron castings fell off 15 per cent and steel castings 8 per cent.

* * *

Favorite Mfg. Co., Piqua, O., has made application for incorporation to take over in part the interests of the Favorite Stove & Range Co. The new organization will feature the manufacture of hollow-ware. Incorporators are as follows: William C. Katker, former president of the Favorite Stove & Range Co; Mrs. William C. Katker; Walter F. Henne; Bernard S. Keyt; and Fred Shane.

* * *

Index of foundry equipment orders for November was 80.4, as compared with 55.3 in October and 36.62 in November, 1933, according to a recent report of the Foundry Equipment Manufacturers association. Index of shipments was 59.6 as against 51.5 in October while unfilled order index was 69.7 as compared with 49.1, in the preceding month. The base of 100 per cent is the average for the years 1922, 23 and 24.

* * *

Chicago district foundry operations were steady during December except for a seasonal slackening among small plants over the holiday week. The industry as a whole, however, made the best showing in years compared with the activity of November and October. Pig iron shipments rose in December for the fifth consecutive month, an unusual record, while foundry coke

shipments also gained over November in addition to being 50 per cent heavier than a year ago. Automotive and farm implement foundries are among the leading melters. Lack of railroad business retards steel foundry operations.

New Trade Publications

CHAPLETS—Combined Supply & Equipment Co., 766 Grant street, Buffalo, recently has issued a booklet on its line of chaplets. This includes angle stem and double angle chaplets, single and double head chaplets, water back chaplets, radiator chaplets, tin or ferrule chaplets, stove specialties, etc. The various types and styles of chaplets are illustrated.

PROTECTED METAL — American Brass Co., Waterbury, Conn., has published a bulletin on its copper covered protected metal for a wide variety of applications.

HEATING EQUIPMENT — National Radiator Corp., Johnstown, Pa., has published a folder illustrating and describing its steam heating furnaces, cast iron convectors and tube-type radiators.

PIG IRON—Chateaugay Ore & Iron Co., 26 Liberty street, New York, has published a booklet discussing the manufacture and the numerous advantages claimed for its low phosphorus pig iron.

CHARCOAL PIG IRON — Superior Charcoal Iron Co., Grand Rapids, Mich., in a recent folder, discusses advantages accruing through the use of its products. The purity of its iron especially is stressed.

CENTRIFUGAL PUMPS—Worthington Pump & Machinery Corp., Harrison, N. J., has published a bulletin on its line of single-stage volute pumps. A sectional drawing shows the construction and lists the parts, while the text presents specifications.

STEEL ABRASIVES—Pittsburgh Crushed Steel Co., Pittsburgh, in a recent folder, outlined seven claims for its line of steel shot and angular steel grit for blast cleaning purposes. A chart shows the sizes of various numbers in both shot and grit.

PIG IRON—Uniformity secured through the mixing of iron in a large ladle before it is pigged is stressed in a recent folder of the Sloss-Sheffield Steel & Iron Co., Birmingham, Ala. A photograph of the ladle, which has a capacity of 125 tons, is reproduced.

WELDING MACHINES—Arc welding machines, manufactured by the Wilson Welder & Metals Co. Inc., and distributed by the Air Reduction Sales Co., are described in a recent bulletin. Advantages of design, construction, and types and capacities of equipment available are included in the text.

CUTTING MACHINES—Air Reduction Sales Co., 60 East Forty-second street, New York, has published a booklet on its tractograph, a portable, motor-propelled hand-guided oxyacetylene cutting machine. The publication contains many illustrations showing construction of the equipment and numerous applications.

TRUCKS—Barrett-Cravens Co., 3261 West Thirtieth street, Chicago, has published two bulletins, one dealing with its line of lift trucks and platforms, and the second with storage racks. Illustrations show application of the various pieces of equipment under discussion.

AIR COMPRESSORS—A line of air compressors for a wide variety of manufacturing plants is presented in a bulletin recently published by the Curtis Pneumatic Machinery Co., St. Louis. Details of construction are presented and several other products including hoists and cranes are illustrated.

PLATING—E. I. Du Pont de Nemours & Co. Inc., Wilmington, Del., has published an operating manual for plating with Duozinc. The information presented covers the preparation of materials for plating, making up the solution, operation, analyzing the solution, testing the deposit and other details.

CONTROLLED EQUIPMENT—General Electric Co., Schenectady, N. Y., recently has published a bulletin on controlled-atmosphere electric furnaces and their auxiliaries. Both continuous and intermittent furnaces for such uses as bright-annealing, scale-free hardening and normalizing, and electric furnace brazing are featured.

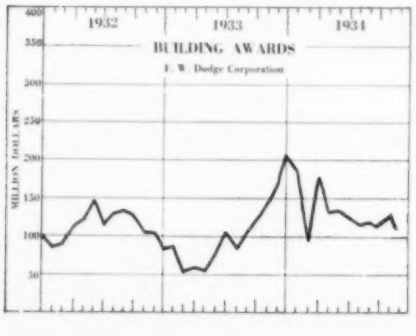
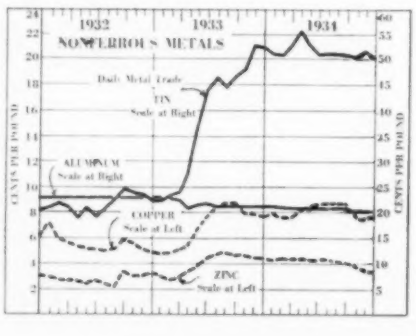
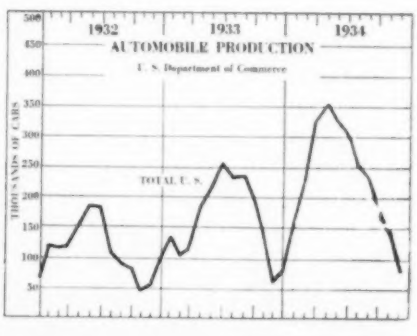
WELDING—Hobart Bros. Co., Troy, O., has published a booklet devoted to carbon arc welding and cutting. Information on procedure is presented and the subject of reclaiming castings in iron and steel foundries with the carbon arc is treated briefly.

MOLDING MACHINES—Herman Pneumatic Machine Co., Union Bank building, Pittsburgh, has presented a bulletin on its pitless jar rollover and pattern drawing molding machines of 1500 pounds capacity. Construction and operating features of the machine are presented by a sectional drawing. Specifications of this type of machine, with turnover plate of four different sizes, also are presented.

BAKELITE BONDED WHEELS—A booklet on high-speed abrasive wheels bonded with bakelite resinoid and designed for fast cutting, has been published by the Bakelite Corp., 247 Park avenue, New York. The text discusses and illustrates a number of applications for high-speed grinding wheels and stresses the special features of wheels bonded with the product of that company.

MEEHANITE—Meehanite Metal Corp., Pittsburgh, Pa., has published a bulletin in which the features of Meehanite are developed. The bulletin is entitled "The Engineers Investigate Meehanite" and compares the physical properties and production problems of Meehanite with other cast metals. A series of three bulletins by the Meehanite Research institute deals with castings advancement, casting design, and die materials. The latter includes a table of performance data on Meehanite dies.

REFRACTORIES, CEMENT and CRUCIBLES—Electro Refractories & Alloys Corp., Andrews building, Buffalo, recently has published an 84-page booklet devoted to its line of products. Part one deals with super refractories for temperature firebox linings, hearths and muffles, heat treating and annealing furnaces, linings for crucible furnaces, nonferrous furnaces, etc. The second section deals with high-temperature cement, the third section with crucibles, the fourth with electroalloys and the fifth presents reference tables. Considerable information, especially of interest to the nonferrous foundry field, is presented.

Faked Foundry Facts

Gaggers